

FINAL REMOVAL ACTION WORK PLAN TIME CRITICAL REMOVAL ACTION SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

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LIST OF ACRONYMS AND ABBREVIATIONS

2H:1V	2 horizontal to 1 vertical
AOC	Administrative Order on Consent
APE	Area of Potential Effect
ARAR	applicable, relevant and appropriate requirement
BMPs	best management practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CHASP	contractor health and safety plan
CQAP	construction quality assurance plan
CWA	Clean Water Act
DGPS	differential global positioning system
EFDC	Environmental Fluid Dynamics Code
ESA	Endangered Species Act
HASP	health and safety plan
HDPE	high-density polyethylene
I-10	U.S. Interstate Highway 10
IAP	Incident Action Plan
ICS	Incident Command System
IPC	International Paper Company
LLDPE	linear low-density polyethylene
MHHW	mean higher high water
MHW	mean high water
MIMC	McGinnes Industrial Maintenance Corporation
MLLW	mean lower low water
MLW	mean low water
MSL	mean sea level
MTL	mean tide level
NAVD88	North American Vertical Datum of 1988
ng/kg	nanograms per kilogram
NIMS	National Incident Management Command System
NMFS	National Marine Fisheries Service

NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRHP	National Register of Historic Places
OC	organic carbon
OM&M	operations, monitoring, and maintenance
OSHA	Occupational Safety and Health Administration
RACR	Removal Action Completion Report
RAWP	Removal Action Work Plan
RI/FS	Remedial Investigation/Feasibility Study
ROW	right of way
RTK	real time kinetic
SHPO	State Historic Preservation Officer
Site	San Jacinto River Waste Pits Superfund Site
SWPPP	Storm Water Pollution Prevention Plan
TCDD	tetracholordibenzo-p-dioxin
TCEQ	Texas Commission on Environmental Quality
TCRA	time-critical removal action
TES	threatened and endangered species
TESC	temporary erosion and sedimentation control
TPDES	Texas Pollution Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TXDOT	Texas Department of Transportation
UAO	Unilateral Administrative Order
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
µg/kg	micrograms per kilogram

1 INTRODUCTION

This document presents the Removal Action Work Plan (RAWP) for implementing a Time Critical Removal Action (TCRA) at the San Jacinto River Waste Pits Superfund Site (Site) in Harris County, Texas (Figure 1-1). The TCRA is being implemented by International Paper Company (IPC) and McGinnes Industrial Maintenance Corporation (MIMC) under an Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA) - Docket No. 06-12-10, April 2010 (USEPA 2010a).

As required by the AOC, this RAWP presents the engineering design and specifications for the TCRA, requirements for protection of worker health and safety, requirements for protection of the environment, and procedures for inspection and documentation of the installation of TCRA elements. The RAWP includes the following major sections:

- Section 1 presents the project background, removal action objectives, and a summary of the preferred alternative as determined by USEPA
- Section 2 describes the Site physical conditions, including hydrodynamics, bathymetry, and geotechnical conditions
- Section 3 presents the engineering design of the various elements of the TCRA
- Section 4 describes TCRA construction, including schedule, environmental protection, quality control, documentation, and health and safety
- Section 5 describes operations, monitoring, and maintenance of the TCRA
- Section 6 provides the list of references
- Appendices include the following:
 - EPA Action Memo (Appendix A)
 - EPA Decision Document to Alternatives Analysis (Appendix B)
 - Technical Specifications (Appendix C)
 - Construction Drawings (Appendix D)
 - Perimeter Fence Construction Drawings (Appendix E)
 - Water Quality Monitoring Plan (Appendix F)
 - Construction Quality Assurance Plan (Appendix G)
 - Health and Safety Plan (Appendix H)
 - Hydrodynamic Modeling (Appendix I)
 - Geotechnical Engineering Analyses (Appendix J)

- Bathymetric Survey and ADCP Data Collection Report (Appendix K)

1.1 Project Background

The Site is located on the San Jacinto River, east of Houston, in Harris County, Texas (Figure 1-1). On March 19, 2008, USEPA listed the Site on the National Priorities List (NPL), and USEPA issued a Unilateral Administrative Order (UAO), Docket No. 06-03-10, to IPC and MIMC on November 20, 2009 (USEPA 2009). The 2009 UAO directs IPC and MIMC to conduct a Remedial Investigation and Feasibility Study (RI/FS) for the Site.

In addition, MIMC and IPC entered into the AOC to conduct a TCRA in April 2010 (USEPA 2010a). The TCRA is to stabilize a portion of the Site (the TCRA Site), abating any release of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans into the waterway from two waste pits until the Site is fully characterized and a remedy is selected (USEPA 2010a).

1.2 Removal Action Objectives

As presented in the Action Memorandum (USEPA 2010a, Appendix A), the following removal action objectives for the TCRA were identified:

- Stabilize waste pits to withstand forces sustained by the river
 - Source materials are considered to be highly toxic located within the original 1966 berm footprint and with concentrations greater than or equal to 330 nanograms per kilogram (ng/kg) tetracholordibenzo-p-dioxin (TCDD) on an organic carbon (OC)-normalized basis or 4.5 ng/kg TCDD non-OC-normalized; samples of the waste pits were recorded as high as 360,000 ng/kg for TCDD (USEPA 2010a, Appendix A, IV.A.1; Page 9; 2nd paragraph).
 - The barrier design and construction must be structurally sufficient to withstand forces sustained by the river including any future erosion and be structurally sound for a number of years until a final remedy is designed and implemented (USEPA 2010b).
 - Technologies used to withstand forces sustained by the river must be structurally sufficient to withstand a storm event with a return period of 100 years until the

nature and extent of contamination for the Site is determined and a final remedy is implemented.

- Prevent direct human contact with the waste materials (USEPA 2010a, Appendix A, IV.A.1; Page 9; 1st paragraph). Humans come into contact with the material accessing the Site by land and water.
- Prevent benthic contact with the waste materials (USEPA 2010a, Appendix A, III.B).
- Ensure that the “actions are consistent with any long term remediation strategies that may be developed for the Site” (USEPA 2010a, Appendix A, V.A.2). Because this action constitutes source control, these actions are consistent with any long term remediation strategies that may be developed for the Site (USEPA 2010a, Appendix A).

1.3 Preferred Alternative Overview

As required by the AOC, the respondents prepared a TCRA Alternatives Analysis (Anchor QEA 2010) of potential options. Upon review of the TCRA Alternative Analysis, EPA selected a temporary granular cover designed to withstand a storm event with a return period of 100 years. The major construction elements of the removal are as follows:

- Construction of a security fence on the uplands to prevent unauthorized access to the Site. This work was completed April 29, 2010.
- Placement of signs indicating DANGER, that this is the location of a Superfund Site, and providing contact information (see Figure 1-2).
- Site preparation, including clearing and grubbing vegetation as necessary, preparation of a staging area, and construction of an access road.
- Installation of a stabilizing geotextile underlayment over the eastern cell. Preference is for installation of a geomembrane.
- Installation of an impervious geomembrane underlayment in the western cell.
- Installation of granular cover above the geotextile and geomembrane in the western cell, above the geotextile in the eastern cell, and in northwestern area.
- Use of appropriate health and safety and environmental control measures during

construction.

- Design and implementation of an Operation and Maintenance plan for the TCRA.

1.4 Applicable, Relevant and Appropriate Requirements

As part of the RAWP, a comprehensive review of Applicable Relevant and Appropriate Requirements (ARARs) was performed. Table 1-1 provides a summary description and discussion of each potential ARAR identified for the TCRA. The table includes an explanation for each ARAR and identifies those ARARs that are relevant to the TCRA. As noted in Paragraph 62 of the AOC and Section 300.415(j) of the National Contingency Plan, ARARs must be obtained for removal actions only to the extent practicable, as determined by EPA. The selected removal action will comply with the relevant ARARs listed in Table 1-1, as described in Section 3.

2 SUMMARY OF EXISTING CONDITIONS

The TCRA Site consists of a set of impoundments approximately 15.7 acres in size, built in the mid-1960s for disposal of paper mill wastes. The Site, as defined by USEPA, also includes the surrounding areas containing sediments and soils potentially contaminated with the waste materials that had been disposed of in the impoundments as well as an impoundment located south of I-10. The set of impoundments is located on a 20-acre parcel on the western bank of the San Jacinto River, in Harris County, Texas, immediately north of the Interstate Highway 10 (I-10) Bridge over the San Jacinto River (Figure 2-1).

In 1965, the impoundments were constructed by forming berms within the estuarine marsh, just north of what was then Texas State Highway 73 (now I-10), to the west of the main river channel. The two primary impoundments at the Site were divided by a central berm running lengthwise (north to south) through the middle, and were connected with a drain line to allow flow of excess water (including rain water) from the impoundment located to the west of the central berm, into the impoundment located to the east of the central berm (Figure 2-1).

In 1965 and 1966, pulp and paper mill wastes (both solid and liquid) were reportedly transported by barge and unloaded at the Site into the impoundments. The wastes deposited in the impoundments have recently been found to be contaminated with polychlorinated dibenzo-p-dioxins, polychlorinated furans (dioxins and furans), and some metals (TCEQ and USEPA 2006). Physical changes at the Site in the 1970s until present include regional subsidence of land in the area. This has resulted in submergence of the eastern impoundment and partial submergence of the western impoundment and exposure of the dioxin waste into the San Jacinto River. Based on permit reviews, dredging occurred in the vicinity of the impoundments.

For purposes of the TCRA design, the TCRA Site has been subdivided into the following areas:

- Eastern Cell
- Western Cell
- Northwestern Area

The location of each of these areas is depicted on Figure 2-1. Physical conditions associated with each area are discussed below.

2.1 Site Hydrodynamic Conditions

Flow rates in the San Jacinto River in the vicinity of the Site are partially controlled by the Lake Houston dam, which is located about 28 miles upstream of the waste impoundments. The average flow in the river is 2,200 cubic feet per second (cfs). Floods in the river primarily occur during tropical storms (e.g., hurricanes) or intense thunderstorms. Extreme flood events (return intervals of 25 years or more) have flow rates of 200,000 cfs or greater. The October 1994 flood had a peak discharge of 360,000 cfs, which has a return period of greater than 100 years. River stage height during the October 1994 flood had a maximum value of 27 feet above mean sea level (MSL).

The river in the vicinity of the waste impoundments is affected by diurnal tides, with a typical tidal range of 1 to 2 feet. Tidal range varies over a 14-day cycle, with neap and spring tide conditions corresponding to minimum and maximum tidal ranges, respectively. Tropical storms and wind storms from the north can have significant effects on water levels at the Site. Tropical storms can cause storm surges with water levels that are significantly higher than typical tidal elevations. Storms with strong winds from the north can cause water to be transported out of the Galveston Bay system, which can result in water levels that are much lower than low tide elevations. Table 2-1 presents a summary of the tidal elevations at the gage that was historically nearest the Site for the 1983 to 2001 tidal epoch, relative to the project vertical datum NAVD88. This gage, National Oceanographic and Atmospheric Administration (NOAA) number 8770743, was damaged during Hurricane Ike and is currently not collecting data.

Table 2-1
Tidal Relationships for Battleship Texas State Park Gage

Datum	Elevation (feet)
NAVD88	0.0
Mean Lower Low Water (MLLW)	0.05
Mean Low Water (MLW)	0.22
Mean Tide Level (MTL)	0.83
Mean Sea Level (MSL)	0.86
Mean High Water (MHW)	1.43
Mean Higher High Water (MHHW)	1.52

Note: Primary benchmark 0743 A 2002 at elevation 11.54 feet NAVD88.

Salinity in the vicinity of the waste impoundments generally ranges between 10 and 20 parts per thousand during low to moderate flow conditions in the river. During floods, salinity values approach freshwater conditions.

2.2 Physical Conditions in Eastern Cell

The eastern cell is characterized by shallow water, with bed elevations ranging from -10 to 0 feet NAVD88. On the west side of the eastern cell, a central berm extends up to elevations as high as 8 feet NAVD88.

Source material in the eastern cell consist of clay varying from low to high plasticity, with 60 to 90 percent fines and water content that ranges from 69 to 147 percent. Subsurface conditions at the Site are described in more detail in Appendix J, and consist of the soft surface source material (silt and clay) overlying sand, which overlies a hard clay formation.

Surface sampling in the eastern cell identified concentrations of 2,3,7,8-TCDD that range from 5.43 to 9,720 micrograms per kilogram ($\mu\text{g/kg}$) dry weight basis or 986 to 360,000 $\mu\text{g/kg}$ OC-normalized basis. Based on six samples, the average concentration of surface samples in the eastern cell is 1,945 $\mu\text{g/kg}$ dry weight, 87,596 $\mu\text{g/kg}$ OC-normalized (Figure 2-2).

2.3 Physical Conditions in Northwestern Area

The northwestern area differs from the eastern cell in that the water is deeper. Typical bed elevations range from -20 to -10 feet NAVD88. The northwestern area is part of the western cell; the two areas are connected by a relatively steep slope (approximately 2 horizontal to 1 vertical [2H:1V]) from the deep water of the northwestern area up to the high ground in the western cell.

Source material in the northwestern area consist of highly plastic clay and silty, clayey sand, with 42 to 66 percent fines, and water content that ranges from 27 to 137 percent.

Source material sampling in the northwestern area identified concentrations of 2,3,7,8-TCDD of 269 and 15,400 µg/kg dry weight or 14,000 and 114,000 µg/kg OC-normalized. From those two samples, the average concentration of source material in the northeastern area is 7,834 µg/kg dry weight, 64,000 µg/kg OC-normalized (Figure 2-2).

2.4 Physical Conditions in Western Cell

The ground surface of the western cell is predominantly above the average water surface elevation in the San Jacinto River. Surface elevations range from approximately 8 feet along the surrounding berms to approximately 2 feet NAVD88 in the center portion of the western cell. The ground surface is largely vegetated in the western cell, however, impounded wastes have been observed at the ground surface.

Surface soil concentrations of 2,3,7,8-TCDD in the western cell range from 2,710 to 7,040 µg/kg dry weight, or 108,000 to 127,000 µg/kg OC-normalized (Figure 2-2).

3 TCRA DESIGN

This section describes the design of the TCRA elements. Project specifications and construction drawings are provided in Appendices C and D, respectively. Appendix C and Appendix D were developed based on the engineering design that is summarized in this section and presented in more detail in Appendices I and J.

3.1 Summary of TCRA Design Elements

This section briefly describes the major project elements of the TCRA for each area of the TCRA Site, as designed to meet the requirements of the USEPA decision document. The work summarized in this section is discussed in more detail later in Section 3. Figure 3-1 provides a plan view of all of the major work elements for the TCRA Site, and Figure 3-2 and 3-3 provide representative cross sections for the work.

3.1.1 *Design Adjustments to the EPA Alternative*

The USEPA alternative is described in Section 1.3. During detailed design of the TCRA, the following adjustments were made (or may be made) to the conceptual design:

- The hydrodynamic model was updated using the revised bathymetry and calibrated using the site-specific current data. Based on this work (Appendix I), the rock revetment between the western cell and northwestern area was modified to a granular cover as shown in the project plans. Both the modeling and conclusions derived from the modeling need to be verified by USEPA.
- The updated bathymetry and revised hydrodynamic model showed that a granular cover was sufficient at the perimeter of the eastern cell and its transition into the northwestern area.
- Based on conversations with contractors, a geotextile was added below the granular cover to provide base stabilization for areas where land-based construction equipment would be used (i.e., the western and eastern cells). The geotextile will also minimize the potential for resuspension of waste materials during construction.
- In order to create a more stable surface for placing cover, the western and central berm may potentially be regraded. This option will be evaluated with the contractor during constructability review, and if selected, details will be submitted to USEPA for approval. Conceptually, if regrading were to occur, it could be on a limited scale, or

occur over a larger area. Limited regrading could entail flattening steep slopes along the central and western berms. In a larger regrading effort, the entire central and western berm would be pushed into the center of the western cell and graded to drain back into the San Jacinto River.

The remaining sections summarize the details of the TCRA design.

3.1.2 Site Preparation and Access

Site preparation will be required to allow the contractor to perform the work, and to isolate the Site from the public. Design elements required for Site preparation and access include:

- Installation of a perimeter security fence
- Preparation of a staging and laydown area if Respondents acquire access
- Obtain access to the TCRA Site via water or land. If land access is acquired, then an access road will be constructed.
- Clearing and grubbing of TCRA Site vegetation as necessary for construction

As discussed above, site preparation may also include regrading of the central and western berms into the footprint of the western cell, depending on constructability analyses that will occur in cooperation with the contractor.

3.1.3 Eastern Cell

The eastern cell will be stabilized by placement of a granular cover. This element of work will include the following two major activities:

- Placement of a geotextile stabilization and filter layer or geomembrane. The geotextile will facilitate construction access by providing a stabilized base upon which to place the granular cover. In addition, it will act as a filter layer to reduce the relatively fine-grained source material from moving into the coarser grained granular cover.
- Placement of the granular cover. The design thickness and gradation of the eastern cell granular cover is discussed in more detail later in this section.

3.1.4 Northwestern Area

The northwestern area will be stabilized by the placement of a granular cover. This work will be accomplished by placing the granular material through the water column in lifts to achieve the required thickness of cover. As an optional element, a geotextile layer may be placed below the granular cover. The need for this element will be determined based on discussions with the contractor during design review.

3.1.5 Western Cell

The western cell will be stabilized by placing a granular cover after clearing and grubbing and Site grading have been completed. The western cell area will first be stabilized by placing import fill and/or a geotextile over the area. Following this, an impervious geomembrane will be installed in the western cell. After placement of the geotextile and geomembrane, the granular cover will be constructed.

3.2 Site Security Design

USEPA required that Site security be implemented as part of the TCRA (USEPA 2010a, Appendix F) by installing a fence and warning signs, and coordinating with the Port of Houston Authority regarding Site access restrictions. On April 16, 2010, the security fence was completed, locked and signage installed on the west bank of the Site. The east bank fence was locked and completed on April 29, 2010. Appendix E provides more details on the fence installation. Additional signage surrounding the waste pits will need to be placed that indicate the presence of a Superfund Site (Figure 1-2).

The contractor will be responsible for site security, including securing all equipment and materials, throughout the duration of construction. Additional temporary fencing may be used for areas outside the TCRA fence to provide additional security during construction.

3.3 Site Preparation Design

Site preparation activities include clearing and grubbing and could potentially include the setup of the staging and laydown areas, construction of an access road to the TCRA Site, and regrading of perimeter berms to facilitate cover material placement.

3.3.1 *Staging and Laydown Area*

A staging and laydown area is desired for import material stockpiles, construction equipment storage and maintenance, construction trailers, and contractor parking. Given the size of the project and the limitations of the existing property, the available on-site staging area is likely not sufficient to support the contractor's potential needs. The respondents are pursuing agreements with adjacent property owners to secure the necessary area for construction staging and laydown. Such agreements will be in place prior to the start of construction.

The contractor will determine whether any improvements are necessary to the staging area based on their project equipment and construction sequencing. At a minimum, temporary erosion and sedimentation control (TESC) measures will be required for all material stockpiles that will be located in the staging area, as described in Section 4.2.2.

3.3.2 *Site Access Road*

An access corridor is present north of I-10 that connects local roads to the Site. This access corridor is marginally improved, with areas of pavement and areas of soft ground and vegetation. Depending on the contractor's selection of equipment to complete the work, this corridor will likely require improvements to support construction access. The corridor is located within the Texas Department of Transportation (TXDOT) right of way (ROW). The respondents are in the process of obtaining an access agreement with TXDOT to allow the use of the ROW during implementation of the TCRA. As part of this process, soil sampling of the access corridor was required. If access is unavailable by land, then the Site will be accessed for the TCRA by water.

The level of improvement necessary is a function of the equipment that the contractor will use. A temporary haul route will be constructed within the TXDOT ROW to connect the Site to local access roads. The design (width of the haul road, as well as the selection and thickness of roadway aggregates and stabilization geotextile) of the improvement will be the responsibility of the contractor. In addition, the contractor will be required to maintain the haul route throughout the duration of TCRA construction. Dust will be minimized by spraying the road with a dust suppressant (e.g. water).

3.3.3 Clearing and Grubbing

Vegetation in the western cell needs to be cleared and grubbed to facilitate installation of the granular cover. Following mobilization, staging area preparation, and access road construction, the above-ground vegetation will be cut down and larger pieces shredded in a drum grinder or other suitable equipment. Any grubbed and shredded vegetation that has visible contamination or intermixed source material will be tested prior to disposal to determine the appropriate disposal facility. All materials generated during this process will be shipped off-site to an approved disposal facility.

After the initial above-ground clearing has been completed, the organic layer and root mat will be grubbed onsite. This material will be spread evenly across the footprint of the western cell and serve as the base layer upon which the granular cover will be constructed.

3.4 Western Cell Geomembrane

An impervious geomembrane will be installed over the western cell to further isolate source materials. The membrane will consist of 40 mil linear low-density polyethylene (LLDPE) material with fully welded seams. LLDPE was selected due to its higher tolerance for differential settlement compared to high density polyethylene (HDPE). The membrane will be secured at its perimeter in accordance with manufacturer's recommendations.

The limits of the geomembrane are depicted on Figure 3-1.

3.5 Granular Cover Design

There are two primary components to the design of the granular cover: the hydrodynamic design (aggregate size and cover thickness to resist the design-level flow event) and the geotechnical component (bearing capacity, slope stability, and filter criteria).

3.5.1 Hydrodynamic Design of Granular Cover

The primary objective of the granular cover material is to address the imminent and substantial endangerment posed by the release and threatened release of dioxin waste sludge from the waste pits into the San Jacinto River. The cover material gradation has been

designed using methods developed by the USEPA and the U.S. Army Corps of Engineers (USACE) and presented in *Armor Layer Design of Guidance for In-Situ Subaqueous Capping of Contaminated Sediments* (Maynard 1998).

As described in Section 2, high flows resulting from rainfall runoff and storm surges can occur in the San Jacinto River. These high flows can result in elevated velocities (and associated bed shear stress) at the Site and have the potential to erode and/or resuspend source material. To evaluate the velocities and shear stresses at the Site for various return-interval flow events, a hydrodynamic model was developed that is still to be reviewed and approved by EPA. This model was used to compute velocities, water depths, and bed shear stresses at the Site under various flow conditions. Results were used to compute representative particle sizes (diameters) that will resist erosion associated with current velocities using the methods presented in Maynard (1998).

The hydrodynamic model used for design is the Environmental Fluid Dynamics Code (EFDC). EFDC is a general purpose hydrodynamic model capable of simulating flow in rivers, lakes, reservoirs, estuaries, and coastal oceans, and has been used at other USEPA Superfund sites in the United States. The EFDC hydrodynamic model of the lower San Jacinto River basin is a two-dimensional, depth-averaged model that predicts flow velocity, water depth, and shear stress. The EFDC model for the lower San Jacinto River was initially proposed, subject to EPA approval, to evaluate flow and source material transport patterns in the San Jacinto River to support the sampling plan design for the Site RI/FS chemical fate and transport modeling study. The model was subsequently refined for use in evaluating flow velocities at the Site. Details of the model development are presented in Appendix I, which is subject to USEPA review and approval.

The analysis described in Appendix I results in the required grain sizes listed in Table 3-1 for the areas presented on Figure 3-1. In order to ensure that sufficient cover material is placed, the total minimum required cover thickness will be at least twice the d_{50} for each material type.

Table 3-1
Cover Material Gradation Requirements

Material Designation	Material Type	d₅₀ (inches)	Minimum Cover Thickness (inches)¹
Cap A	recycled concrete	3	6
Cap B	recycled concrete	5	12
Cap C	recycled concrete	6	12
Cap D	natural stone	8	18
Cap E	natural stone	12	24

¹ Note that the actual thickness shown on the construction drawings may be greater than this minimum thickness, depending on other design and constructability considerations.

The grain size of materials placed in the surf zone was evaluated for compatibility to resist potential vessel-generated waves. For the typical tug class that operates in the river channel and a “no-wake zone” speed of 4 knots, vessel-generated waves less than 1 foot high would be expected. Cap B and larger-sized materials, which will be located in the surf zone, are capable of resisting waves on the order of 2 to 2.5 feet high with very little movement.

3.5.2 Geotechnical Design of Granular Cover

3.5.2.1 Bearing Capacity

Bearing capacity for the granular cover was evaluated using methods described in Appendix J. When cover material is placed on the surface of soft waste sludge, there is a potential for a bearing capacity failure of the waste sludge, which would result in a mud wave developing during construction. The initial cover lift thickness must be appropriately designed to prevent a bearing capacity failure from the weight imposed by the placement of the cover material.

In the short term, the risk of bearing capacity failure can be minimized by staged loading and by controlling the initial lift thickness of material so that the bearing load on the surface of the pits that could cause failure is minimized. Once this initial lift of material is placed, consolidation of the underlying soft source material begins and the *in situ* source material gains strength. Subsequent lifts of cover material can be placed onto this new surface, which

is a layered system of higher strength granular material over more consolidated (i.e., higher strength) sediment.

As described in Appendix J, an initial lift thickness of 14 inches or less will result in a short-term factor of safety of 1.5 or higher against bearing capacity failure.

3.5.2.2 *Slope Stability*

As mentioned in Section 2, the TCRA Site has a relatively steep (2H:1V), submerged slope between the western cell and the northwestern area. Granular cover (Cap A material) is required on this slope based on the hydrodynamic analysis. The stability of a 6-inch-thick layer of Cap A material placed on this slope was evaluated using limit-equilibrium slope stability software as described in Appendix J.

Based on the slope stability evaluation, short-term factors of safety are appropriate based on published recommendations by USACE (USACE 2003). The short-term (end of construction) factor of safety for the slope area is greater than 1.3 after the granular cover is placed.

3.5.2.3 *Filter Design*

For the majority of the TCRA Site, a geotextile will be used to separate the granular cover materials from the source material, as described in the following section. This geotextile will be placed to facilitate construction activities, but will also serve as a separation layer to prevent the migration of source material into the granular cover interstices.

Where material will be placed using marine construction equipment (in the northwestern area), it may not be possible to effectively place a geotextile due to the constraints of working in deep water. At the same time, construction equipment will not work directly on the source material surface because floating equipment will be used. Thus, the grain size of the granular material used in this area (Cap A, Table 3-1) must be compatible with the source material grain size so that source material does not migrate into the interstices of the cover material.

Appendix J describes the “filter criteria” design method that was used to evaluate the compatibility between the grain size of *in situ* source material and the grain size of the Cap A material. Based on this evaluation, a graded filter material was selected for blending with Cap A material so that the filter criteria will be met and the migration of fines from source material into the cover will not occur.

Table 3-2 presents the required gradation of the filter material that will be blended with Cap A material to be compatible with TCRA Site sediments. As described in Appendix J, the filter material will be blended with Cap A at a ratio of 20 percent filter material to 80 percent Cap A material, by weight.

Table 3-2
Cap A Filter Material Gradation

U.S. Standard Sieve Size	Percent Passing
3/8-inch	100%
U.S. No. 4	50 to 90%
U.S. No. 10	10 to 40%
U. S. No. 200	0 to 4%

3.6 Granular Cover Placement

The granular cover will be placed with a combination of upland-based conventional earthwork equipment, or a water-based crane and barge depending on where the work is occurring.

Prior to placing the granular material using conventional earthwork equipment, a base geotextile will be rolled out over the footprint of the cover. The geotextile will have sufficient overlap from one panel to another to ensure complete coverage, as described in the specifications (Appendix C). Where geotextile is placed under water, weights such as sand bags or concrete will be used to hold the geotextile in position until the granular material is placed on top. The selected geotextile for this use is a high puncture strength non-woven geotextile (Mirafi 1120N or equivalent) with sufficient durability to withstand construction.

The successful use of high strength non-woven geotextiles has been demonstrated in erosion control applications where larger rock aggregates are placed directly on the geotextile (Mirafi 2006).

For land-based placement, the granular cover will be delivered to the Site and stored in stockpiles. The material will be moved into the work area and placed in controlled lifts using front end loaders, dump trucks, and a bulldozer. In the eastern cell, which is submerged at higher water levels, the contractor may elect to use marsh buggy earthwork equipment. No additional compaction will be used on the granular cover beyond the densification caused by the movement of construction equipment across the cover surface.

For aquatic placement, a material barge will be loaded with the required aggregate and staged adjacent to the work area. A barge-mounted excavator or crane will be used to take aggregate from the material barge and place it in the cover area. The contractor will determine their means and methods to ensure that the design thickness of material is placed and will be required to demonstrate that their placement methods will result in a granular cover of the required thickness. This demonstration will be made in an easily accessible, visible location (e.g., barge deck) prior to the start of placement, and will be reviewed by the resident engineer before the means and methods are accepted for aquatic placement.

Daily surveys will be performed as described in Appendix G to ensure that the contractor is meeting the required grades and thickness for cover materials.

3.7 Compliance with ARARs

As previously mentioned, Paragraph 62 of the AOC and Section 300.415(j) of the National Contingency Plan states that ARARs must be obtained for removal actions only to the extent practicable, as determined by EPA. This section describes how the design of the TCRA elements is in compliance with the relevant ARARs identified in Table 1-1.

3.7.1 Water Quality and Water Resources

3.7.1.1 Section 303 and 304 of the Clean Water Act (CWA) and Texas Surface Water Quality Standards

Section 303 of the Clean Water Act (CWA) requires states to promulgate standards for the protection of water quality based on federal water quality criteria. Federal water quality criteria are established pursuant to Section 304.

Demonstration of substantive compliance with Section 303 and 304 of the CWA will be achieved by:

- Best management practices (BMPs) have been incorporated into the design to support water quality and attainable use standards for this section of the San Jacinto River. These BMPs include the use of silt fences to manage upland runoff, plastic sheeting to cover upland stockpiles, and other erosion control measures as described in the plans and specifications (Appendices C and D).
- Water quality monitoring will be performed as described in the Water Quality Monitoring Plan (Appendix F) to detect potential impacts on water quality and trigger the implementation of additional BMPs or an interruption of construction if necessary.

3.7.1.2 Section 401 Water Quality Certification of the CWA as Administered by Texas

Section 401 requires that the applicant for federal permits obtain certification from the appropriate state agency that the action to be permitted will comply with state water quality standards. The proposed activity does not require a federal permit because it is an on-site Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action. Therefore, certification is not legally required but should occur as part of the identification of substantive state ARARs (USEPA 1988).

As discussed previously in this section, the design incorporates some elements to comply with state water quality standards. Consultation with the Texas Commission on Environmental Quality (TCEQ) is necessary to confirm that the TCRA design meets the substantive requirements of Section 401 of the CWA.

To support this consultation, the Respondents will:

- Prepare a Section 401 “Tier 2” Water Quality Certification questionnaire for the proposed project
- Conduct a meeting or conference call with TCEQ regarding the questionnaire and elicit feedback
- Provide agency feedback to the design team for incorporation in the design if needed
- Provide documentation of the consultation to EPA

3.7.1.3 Section 404 and 404 (b)(1) of the Clean Water Act

Section 404 requires that discharges of fill to waters of the United States serve the public interest. In selecting capping as the TCRA, USEPA made the determination that the placement of capping materials in the San Jacinto River serves the public interest as necessary to temporarily control the release of source material from the Site. As the construction activity is on-site, a permit is not required.

The Site is in a wetlands and a plan will need to be established that addresses the requirements (to the extent practicable) of Section 404 and 404(b)(1). In addition to previous efforts to minimize or avoid dredge and fill within jurisdictional waters during the design development, the Respondents will also document those approaches in a draft 404(b)(1) report. In addition, the Respondents will:

- Prepare a potentially jurisdictional waters of the U.S. (including wetlands) report in compliance with the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual and Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region
- Prepare a draft 404(b)(1) report for consideration by EPA.
- Revise the draft 404(b)(1) report to address the EPA’s comments
- Provide the final 404(b)(1) report to the EPA

Specific measures that will be taken during construction to minimize discharges of fill into the water include:

- The use of a silt curtains and debris booms around the in water work area
- The use of upland erosion controls such as plastic covering in stockpiles

- The use of silt fence around upland areas
- Construction of a stable upland haul route capable of handling construction traffic without creating ruts that would develop into a source of turbid water
- Monitoring and maintenance during construction to ensure these best management practices are functioning as designed

3.7.1.4 Texas Pollutant Discharge Elimination System (TPDES)

For this effort, discharges from the TCRA are anticipated to be on-site. On-site discharges do not require a permit but do require demonstration of substantive compliance (USEPA 1988). Within the state of Texas, the National Pollutant Discharge Elimination System (NPDES), which demonstrates compliance with Section 402 of the CWA, is administered by TCEQ and referred to as Texas Pollutant Discharge Elimination System (TPDES). To demonstrate substantive compliance with TPDES, the following measures will be taken:

- The contractor will be required to prepare a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the general permit requirements of TXR150000 (the TPDES permit for construction activities).
- The contractor will be required to implement appropriate monitoring during construction.

3.7.2 Rivers and Harbor Act and Texas State Code Obstructions to Navigation

Within the state of Texas, the principal navigable waterways in Texas include the Gulf coastal bays, the Gulf Intracoastal Waterway, the Trinity River from the Gulf of Mexico to Fort Worth, and the ship channels serving Gulf ports (Texas Department of Transportation 2004). Most rivers and streams entering the Gulf of Mexico are technically navigable for a specified distance inland from their mouth. Navigability of rivers in the USACE Galveston District is determined on a case-by-case basis (USACE 1999).

The State of Texas regulates the obstruction of navigable waters within the state involving the construction of structures, facilities, and bridges or removal and placement of trees that would obstruct navigation (TPWD 2008). The State of Texas considers land within the bed and banks of rivers to be public and requires access for the public to such areas. Use of sand

and marl from state-owned lands is permitted under the authority of the Texas Parks and Wildlife Department (TPWD). With the exception of the area that is required to be restricted to minimize potential human health exposure, the actions described in this RAWP will not limit public access.

The lateral extent of the TCRA Site has been defined by USEPA. The actions described in this RAWP will temporarily limit public access but the public access is limited to prevent exposure to humans to the contents of the waste pits.

3.7.3 *Protected Species Requirements*

This section addresses requirements of the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, the Bald and Golden Eagle Protection Act, and the Migratory Bird Treaty Act. The TCRA is within a marsh next to a highway overpass. However, the Site is upstream of Galveston Bay, which provides rearing, spawning, and adult habitat for numerous marine and estuarine fish and invertebrate species including blue crab, drum, flounder, oysters, spotted sea trout, and shrimp. Sea turtles, including the federally listed green, hawksbill, Kemp's Ridley, leatherback, and loggerhead turtles occasionally enter Galveston Bay to nest and feed (NOAA 2010a). The National Marine Fisheries Service (NMFS) includes the ESA-listed sea turtles in Trust resources impacted by contaminated surface water and sediments, but these turtles are not likely to be in the project vicinity.

To address these concerns, the respondents propose the following:

- Conducting a threatened and endangered species (TES) survey by a qualified biologist to determine the presence or absence of protected species and their habitat
 - Incorporation of BMPs into the design to prevent or minimize incidental construction-related releases that could potentially impact protected species off-site.
- The design and overall goal of the TCRA is to improve habitat conditions through the anticipated reduction of contaminants released to the environment.

Pursuant to CERCLA 121(e) and USEPA policy, consultation with the U.S. Fish and Wildlife Services (USFWS) and NMFS is needed to determine if protected species and their habitat will be affected by the proposed site activities even though a permit is not required. If the

TES survey indicates an absence of protected species or habitat, the Respondents will submit their findings to the agencies for concurrence.

In the event that protected species or their habitat are identified within the action area or USFWS and/or NMFS request further study, a Biological Assessment will be developed by the Respondent to identify and discuss species and impacts, potential mitigation measures, and assess potential effects per the requirements of the ESA. Consultation, either formal or informal, would be required depending on the magnitude of effects. If protected species or their protected habitats are found or otherwise determined to be present in the project area, USEPA would consult with the resource agencies.

3.7.4 Coastal Zone Management Act and Texas Coastal Management Plan

Federal agency activities that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone (also referred to as coastal uses or resources and coastal effects) must be consistent to the maximum extent practicable with the enforceable policies of a coastal state's federally approved coastal management program (NOAA 2010b). The General Land Office administers the Texas Coastal Management Consistency certification.

Substantive compliance with the certification would be demonstrated by:

- Evaluating the effects of the proposed design on critical areas (if any) and associated criteria including no net loss of critical area functions and values.
- Evaluating the design's compliance with the Texas Coastal Zone Management Consistency Determination and policies identified in the application for Consistency with the Texas Coast Management Program.
- Supporting the USEPA's consultation with the Galveston District USACE and Texas General Land Office.

3.7.5 Flood Plain

A hydrologic evaluation subject to USEPA approval was performed to evaluate the cap's effect on the water levels in the San Jacinto River. USEPA will evaluate whether the temporary cover will significantly affect water levels. The hydrodynamic evaluation is discussed in Section 3.5.1 and results are presented in more detail in Appendix I.

3.7.6 Cultural Resources Management

No historic properties eligible for listing in the National Register of Historic Places (NRHP) are recorded on-site (Anchor QEA and Integral 2010). Respondents will consult with the State Historic Preservation Officer regarding the No Effects determination presumed by Respondents. To implement that consultation, the Respondents will:

- Update the previous literature-based cultural resources report with any new information as well as site photos.
- Prepare and submit Section 106 consultation letter with the report for submittal to the Texas Historic Commission. The letter will include construction best management practices in the eventuality that unanticipated archaeological resources are discovered.
- Conduct conference call or meeting with the Texas Historical Commission, which is the State Historic Preservation Officer¹.
- Provide the resulting correspondence, comments, and original reports to the USEPA.

3.7.7 Noise Control Act

Noise abatement may be required if actions are identified as a public nuisance. Due to the TCRA site being bounded by water on three sides and adjacent to a highway overpass on the fourth side, noise from the construction activity is unlikely to constitute a public nuisance.

¹ If field surveys are requested, the following would be performed prior to commencing work:

- Determining the Area of Potential Effects (APE)
- Identifying whether the planned work will affect any NRHP-eligible properties in the APE by:
 - Conducting a small-scale field work effort to supplement previous work efforts and generate a reconnaissance survey (Council of Texas Archaeologists 2010)
 - If appropriate (based upon the nature of planned disturbance, results of the reconnaissance survey, and consultation with the State Historic Preservation Office [SHPO] and interested and affected Indian tribes), conducting a more intensive survey and reporting effort
- Consulting with SHPO and any interested and affected Indian tribes; and
- Developing a Memorandum of Agreement to resolve adverse effects, if necessary.

If necessary, BMPs would be implemented to reduce the noise levels. If materials are delivered to or removed from the project area by truck, noise greater than 60 decibels in close proximity to sensitive receptors (schools, residential areas, hospitals, and nursing homes) will be avoided. Truck routes will be selected to avoid sensitive receptors to the extent practicable and working hours will be limited, if necessary, to avoid creating a public nuisance.

3.7.8 Hazardous Materials Transportation

The TCRA will be performed on-site and does not require the removal of significant amounts of material from the TCRA Site. Incidental off-site disposal will be required for limited quantities of waste such as used personal protective equipment and vegetation. The contractor will be required to package any hazardous materials in appropriate containers and label containers in accordance with TXDOT requirements.

4 TCRA CONSTRUCTION AND MONITORING

This section describes the TCRA construction schedule, environmental monitoring and protection procedures, quality assurance and documentation, and protection of worker health and safety during construction.

4.1 Construction Schedule

The following major construction elements are required to complete the TCRA work. Each item, shown in Table 4-1, is in approximate sequential order. Figure 4-1 presents a detailed construction schedule for the project, including conceptual interrelationships between each of these project elements. This schedule is subject to change because of weather and other unforeseen circumstances, and will be reviewed and refined by the TCRA contractor and continuously updated throughout the duration of the TCRA work.

Table 4-1
Construction Elements and Duration

Element	Duration
Mobilization	1 week
Site Preparation and Access Road Construction	
Laydown area preparation	1 week
Access road construction	1 weeks
Clearing and grubbing site	2 weeks
Site Stabilization	
Geotextile and geomembrane placement	6 weeks
Cap A placement	6 weeks
Cap B placement	10 weeks
Cap C placement	6 weeks
Cap D placement	4 weeks
Cap E placement	1 week
Site Cleanup	2 weeks
Demobilization	1 week
Total Duration¹	36 weeks

1 – Note: “Total Duration” is not equal to the sum of all activities because some overlap of tasks has been assumed. Actual duration will be determined by the contractor during their project planning.

4.2 Environmental Monitoring and Protection

Environmental protection will be maintained during TCRA implementation through a combination of the following:

- Monitoring of the construction work, as described in Appendix F
- Physical controls (i.e., silt curtains and silt fences)
- BMPs applied to construction operations

4.2.1 Environmental Monitoring

Environmental monitoring will be performed by the respondents throughout the duration of construction. Details of the water quality monitoring are provided in Appendix F. In summary, the environmental monitoring includes the following major elements:

- Water quality monitoring during in-water work. A background and mixing zone location will be monitored for turbidity to determine whether construction activities are potentially causing resuspension of Site source material. Based on the results of the water quality monitoring, the contractor may be required to implement additional BMPs or may be required to temporarily stop work until the water quality issue can be resolved.
- Daily inspection of upland controls. TESC elements will be inspected on a daily basis by the contractor and the resident engineer. Any defects that are identified will be repaired immediately by the contractor.

4.2.2 Physical Controls

Physical controls will be used to separate the work area from the surrounding environment, both in the uplands and in the river.

In the upland area, a silt fence will be used to prevent the unfiltered runoff of stormwater from entering the river. The contractor will be required to install and maintain the silt fence as part of their TESC work, as described in Appendix A. In addition to installing silt fence, the contractor will be required to cover all stockpiles susceptible to erosion with plastic to prevent infiltration of rainwater and to control erosion of the stockpile. The stockpile covers

will be weighted with sandbags or other suitable means to prevent them from blowing off in the wind.

The TCRA Site will be protected by a security fence to separate it from access by the general public. In addition, the contractor will use supplemental temporary fencing as necessary to protect the public from construction activities and to secure construction operations from unauthorized access by the public.

In the river, the contractor will deploy a debris boom and silt curtain surrounding the in-water work area. The silt curtain will retain suspended source material and restrict the uncontrolled release of turbidity outside of the immediate work area. The debris boom will contain debris that might generated by the work. The contractor will remove floating debris from within the boom at the end of every work day as necessary. The silt curtain and debris boom will be inspected daily and damage will be repaired immediately upon discovery.

4.2.3 Best Management Practices

The contractor will be required to employ BMPs to control water quality impacts during construction. The following BMPs will be required:

- Cap lift thickness will be controlled to prevent bearing capacity failure and/or development of a mud wave at the leading edge of the cover. As described in Appendix J, the initial lift of cap material will be no more than 14 inches thick. Once the initial lift is in place, subsequent lifts will be supported by the first lift of cap material and will pose minimal risk for causing resuspension or mud wave development.
- Equipment will be inspected daily for drips or leaks. Any equipment with drips or leaks will be taken out of service until repairs are made.
- The contractor will be required to maintain a spill kit on-site. This kit will have suitable materials to contain and collect any petroleum products that might spill from construction equipment.
- The contractor will be required to fuel all equipment in a designated area that can be easily accessed and contained in the event of a spill during fueling.

Additional BMPs may be instituted in the event that further controls are warranted. For example, the contractor may be required to limit their work activities to slack tide periods and/or calmer sea states depending on conditions observed in the field.

4.3 Quality Control

Quality control procedures to ensure that the work is conducted in accordance with the plans and specifications are described in the Construction Quality Assurance Plan (CQAP; Appendix G). Quality control will be ensured by the presence of an experienced construction management oversight team working on behalf of the respondents. This team will be on-site to observe and document the day-to-day operations and to perform quality checks as necessary to ensure the requirements of the plans and specifications are being met.

The following procedures will be used to verify and document the quality of the work:

- Bathymetric and topographic surveys will be performed to evaluate the progress of the work, document the thickness of granular cover placed, and to ensure that required thicknesses are achieved as described in the plans and specifications. Periodic progress surveys will be performed by the contractor during the work to ensure that the work is progressing as expected, and to evaluate whether adjustments are necessary to the contractor's operations. A post-construction survey will be performed to create an as-built record of the work completed, and will be used to evaluate contractor payment for work completed.
- A mass balance will be computed for aggregate placed. Each load of rock delivered to the site will be tracked by weight. For truckloads, weight tickets from certified scales will be required. For barge delivery, loaded barge displacement information will be required. The weight of each material type placed will be converted to volume using a conversion factor provided by the material supplier. This volume will be compared to the surface area of coverage to ensure that adequate material has been placed to meet the minimum thickness requirements described in the construction drawings and specifications.

Daily quality control observations will be made by the construction management team and documented as described in the CQAP and summarized in the next section of this report.

4.4 Documentation

The contractor will utilize the organizational management structure process referred to as the Incident Command System (ICS) and the National Incident Management Command System (NIMS) during the removal process with USEPA. An Incident Action Plan (IAP) and other ICS documentation will be generated as appropriate when working on with the USEPA on the removal project. Specific documentation required for the project is described in detail in Appendix G. There are several categories of documentation that will be required:

- Pre-construction documentation
- Construction documentation
- Post-construction documentation

Pre-construction documentation includes contractor work plans, quality management plans, health and safety plans (HASPs), survey control plans, and construction schedule. These plans will be developed by the contractor and are subject to review and approval by the respondents and USEPA as described in the AOC (USEPA 2010a).

During construction, the contractor will prepare a daily quality control report. This report will also be summarized on a weekly basis. A weekly construction meeting will be held to discuss project progress and issues as they develop. Minutes from these meetings will be prepared and maintained in the project file. In addition, the respondents' on-site construction management team will maintain an independent daily record of project activities. These records will include any reports of environmental monitoring that was performed, as described in Appendix F.

Once construction has been completed, completion report will be prepared as required by the AOC and described in detail in Appendix G.

4.5 Health and Safety

Health and safety will be of primary importance for all Site workers. The contractor will be required to develop and abide by their own health and safety plan (CHASP). The requirements for the CHASP are presented in the specifications (Appendix C). The CHASP will be subject to review and approval by the resident engineer and USEPA.

In addition to the CHASP, the Respondents' construction management team and all Site visitors will be required to follow the approved health and safety plan (HASP) presented in Appendix H. At a minimum, all staff working on-site will be required to have a current Occupational Safety and Health Administration (OSHA) 40-hour HAZWOPR certification or refresher.

The contractor will be required to hold tailgate safety meetings at the start of each work shift. At a minimum, these safety meetings will discuss the following topics:

- Health and safety communications and emergency response procedures
- Work planned for the day
- Potential risks associated with the planned work
- Personal protective equipment requirements
- Near miss or close calls observed by workers
- Open discussion of worker concerns regarding health and safety

5 OPERATIONS, MONITORING, AND MAINTENANCE

The TCRA is the first in a series of actions for the Site. For planning purposes, USEPA has directed that operations, monitoring, and maintenance (O & M) of the TCRA occur until the nature and extent of contamination is determined and a final remedy is selected for the Site.

5.1 Monitoring Activities

The following monitoring activities will be performed to ensure the continued functioning of the TCRA:

- Periodic visual inspections of the TCRA components
- Bathymetric surveys to monitor the thickness of the granular cover
- Contingency waste sludge probing observations

5.1.1 Periodic Visual Inspections

The Respondents will make periodic visual inspection of the TCRA elements. The following project elements will be visually inspected:

- Condition of the security fence and signage
- Condition of the armored cap
- Visual confirmation that waste materials are not being actively eroded into the river

Visual inspections will be performed quarterly for the first 2 years, semiannually from years 3 to 5, and annually starting at year 6. A field report will be prepared documenting the visual inspection and will include representative photographs of TCRA Site conditions. Additional visual inspections will be performed as necessary following extreme weather events.

5.1.2 Bathymetric surveys for cover

A bathymetric survey will be performed quarterly for the first 2 years after construction, semiannually from years 3 to 5, and annually at year 6 to evaluate any changes in the top elevation of the TCRA granular cover. Additional bathymetric surveys will be performed as necessary following extreme weather events. The survey will be performed in the same vertical datum as the design documents. The survey will be performed at low tide with a

level rod and real time kinetic (RTK) differential global positioning system (DGPS), or during mid- to high-tide times using a shallow draft boat.

Bottom soundings will be made on 25-foot trackline intervals over the entire footprint of the TCRA granular cover. Surveys will be performed in accordance with accuracy and quality assurance/quality control (QA/QC) standards established by USACE (USACE 2002).

An additional bathymetric survey will be performed as necessary following any storm event that exceeds the design-level event for which the TCRA was designed.

Each bathymetric survey will be compared with the prior survey. Where surveyed elevations are within 6 inches of one another, the results will be considered within the margin of survey accuracy and will not be cause for contingency actions unless visual observations indicate that the discrepancy was due to the loss of granular cover material.

Elevation changes of 6 inches or more between surveys will be cause for additional evaluation. If the most recent survey elevation is more than 6 inches higher than the prior survey, the elevations will be re-checked and the survey benchmarks will be verified. If the most recent survey elevation is substantially less than the prior survey, contingency source material probing observations may be initiated as described in this section.

5.1.3 Contingency Waste Sludge Probing Observations

If review of bathymetric survey data is inconclusive regarding the thickness of cover, contingency source material probing observations may be performed to evaluate the thickness of cover material present in the area of interest. These surveys may be diver assisted if necessary. A 1-inch diameter galvanized steel pipe probe will be hand-deployed by a diver or from a vessel capable of operating in shallow water. The probe will be used to penetrate the cover material down to the geotextile layer and the thickness of cover determined based on this probing.

The contingency probing observations will be used to evaluate whether the required thickness of granular cover is present in the area of interest.

5.2 Maintenance Activities

The respondents will initiate an on-call agreement with a local contractor that can respond to the TCRA Site on short notice as described below. This contractor will be available to provide emergency repairs in the event that TCRA elements are damaged.

In the event that damage to the granular cover is suspected, the Respondents will initiate a site visit within 24 hours and the TCRA elements will be evaluated through a visual inspection. A written report will be transmitted to USEPA within 24 hours of the inspection. Following USEPA's review of the inspection report, a repair plan will be developed by the Respondents. The proposed repair plan will be submitted to USEPA for review and approval. Mobilization for the repair response will begin within 24 hours of USEPA approval of the proposed repair. Figure 5-1 presents the timeline for this sequence of events.

If material has been scoured but a substantial flow event has not occurred, the damage will be evaluated to determine whether it was caused by anchor drag, vessel grounding, or some other type of impact force. In this case, the cover will be repaired with similar-sized material, and Site restrictions will be reviewed to determine if additional perimeter barriers or other measures should be implemented to protect the TCRA elements.

If the cover damage is not obviously related to impact forces and there has not been a significant flow event, the grain size of the granular cover may need to be re-evaluated for the scour repair. The hydrodynamic model will be recalibrated using flow data from the event that likely caused the damage and the grain size of the cover material that was scoured in order to determine an appropriate gradation for the repair material.

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TABLES

Table 1-1
ARAR Screening for the San Jacinto River Waste Pits Superfund Site, Time Critical Removal Action

Potential ARARs ¹	Citation	Summary	Comment	Relevance to TCRA
Federal				
Clean Water Act (CWA): Criteria and standards for imposing technology-based treatment requirements under §§ 309(b) and 402 of the Act	33 U.S.C. §§ 1319 and 1342 (implementing regulations at 40 CFR Part 125 Subpart A)	Both on-site and off-site discharges from CERCLA sites to surface waters are required to meet the substantive CWA (National Pollutant Discharge Elimination System) NPDES requirements (USEPA 1988).	On-site discharges must comply with the substantive technical requirements of the CWA but do not require a permit (USEPA 1988). Off-site discharges would be regulated under the conditions of a NPDES permit (USEPA 1988). Standards of control for direct discharges must meet technology-based requirements. Best conventional pollution control technology (BCT) is applicable to conventional pollutants. Best available technology economically achievable (BAT) applies to toxic and non-conventional pollutants. For CERCLA sites, BCT/BAT requirements are determined on a case-by-case basis using best professional judgment. This is likely to be a potential requirement only if treated water or excess dredge water is discharged during implementation. The proposed activity does <u>not</u> involve a discharge of water.	No
CWA Sections 303 and 304: Federal Water Quality Criteria	33 U.S.C. §§1313 and 1314 (Most recent 304(a) list as updated to issuance of ROD)	Under §303 (33 U.S.C. §1313), individual states have established water quality standards to protect existing and attainable uses (USEPA 1988). CWA §301(b)(1)(C) requires that pollutants contained in direct discharges be controlled beyond BCT/BAT equivalents (USEPA 1988). CERCLA §121(d)(2)(B)(i) establishes conditions under which water quality criteria, which were developed by USEPA as guidance for states to establish location-specific water quality standards, are to be considered relevant and appropriate. Two kinds of water quality criteria have been developed under CWA §304 (33 U.S.C. §1314): one for protection of human health, and another for protection of aquatic life. These requirements include establishment of total maximum daily loads (TMDL).	Best management practices (BMPs) have been established for TCRA operations and will be applied during construction. Water quality will be monitored during construction and additional BMPs may be implemented if necessary to protect water quality. Where water quality state standards contain numerical criteria for toxic pollutants, appropriate numerical discharge limitations may be derived for the discharge and considered (USEPA 1988). Where state standards are narrative, either the whole-effluent or chemical-specific approach may generally be used as a standard of care (USEPA 1988).	Yes

¹ ARARs are applicable or relevant and appropriate requirements of Federal or state environmental laws and state facility siting laws. CERCLA section 121(d) requires that remedial actions generally comply with ARARs. The USEPA has stated a policy of attaining ARARs to the greatest extent practicable on removal actions (USEPA 1988). USEPA also stated that certain nonpromulgated Federal and state advisories or guidelines would be considered in selecting remedial or removal actions; these guidelines are referred to as TBCs, or “to be considered.”

Potential ARARs ¹	Citation	Summary	Comment	Relevance to TCRA
CWA Section 307(b): Pretreatment standards	33 U.S.C. §1317(b)	CERCLA §121(e) states that no federal, state, or local permit for direct discharges is required for the portion of any removal or remedial action conducted entirely on-site (the aerial extent of contamination and all suitable areas in close proximity to the contamination necessary for implementation of the response action) (USEPA 1988).	If off-site discharges from a CERCLA response activity were to enter receiving waters directly or indirectly, through treatment at a Publicly Owned Treatment Works (POTWs), they must comply with applicable federal, state, and local substantive requirements and formal administrative permitting requirements (USEPA 1988). This requirement may be triggered by disposal methods for waste The proposed activity does <u>not</u> involve a discharge of water.	No
CWA Section 401: Water Quality Certification	33 U.S.C. §1341	Requires applicants for Federal permits for projects that involve a discharge into navigable waters of the U.S. to obtain certification from state or regional regulatory agencies that the proposed discharge will comply with CWA Sections 301, 302, 303, 306, and 307.	Although the proposed activity is on-site and does not require a Federal permit, certification is not legally required but should occur as part of the state identification of substantive state ARARs (EPA 1988). Compliance with water quality criteria is discussed under CWA Sections 303 and 304.	Yes
CWA Section 404 and 404(b)(1): Dredge and Fill	33 U.S.C. §1344 (b)(1) (implementing regulations at 33 CFR 320 and 330; 40 CFR 230)	Discharges of dredged and fill material into waters of the United States must comply with the CWA §404 (33 U.S.C. 1344) guidelines and demonstrate the public interest is served (USEPA 1988).	The San Jacinto site is classifiable as a water of the U.S. (USEPA 2007). Dredge and fill permits are applicable to dredging, in-water disposal, capping, construction of berms or levees, stream channelization, excavation and/or dewatering within waters of the U.S. (USEPA 1988). Permits are not required, however, for on-site CERCLA actions. Under the 404(b)(1) guidelines, efforts should be made to avoid, minimize, and mitigate adverse effects on the waters of the U.S. and, where possible, select a practicable (engineering feasible) alternative with the least adverse effects. The substantive requirements of Section 404 were considered in the selection of the TCRA. The cap required to achieve the removal action objectives is designed to minimize adverse impacts to waters of the U.S.	Yes
Safe Drinking Water Act	42 U.S.C. §300f (implementing regulations at 40 CFR Part 141, et seq.)	The Safe Drinking Water Act is applicable to public drinking water sources at the point of consumption (“at the tap”). Maximum contaminant levels (MCLs) have been established for certain constituents to protect human health and to preserve the aesthetic quality of public water supplies.	The Safe Drinking Water Act is applicable to public drinking water sources and relevant to CERCLA projects where a release impacts or threatens to impact a public drinking water supply. The San Jacinto river is not a public water supply and does not recharge an aquifer used to supply drinking water.	No
Federal Drinking Water Regulations (Primary and Secondary Drinking Water Standards) ²	40 CFR 141 and Part 143	USEPA has established two sets of drinking water standards: one for protection of human health (primary) and one to protect aesthetic values of drinking water (secondary) (USEPA 1988). MCLs are applicable to public drinking water sources at the point of consumption.	The Safe Drinking Water Act standards are applicable to public drinking water sources. The San Jacinto river is not a public water supply and does not recharge an aquifer used to supply drinking water. The MCL for 2,3,7,8-tetrachlorodibenzodioxin may be considered for protecting water quality.	No

² Underground injection is not anticipated as a part of this TCRA. Furthermore, the site is not located in a sole-source aquifer (USEPA 2008). It is also assumed that no wellhead protection area is located near the study area.

Potential ARARs ¹	Citation	Summary	Comment	Relevance to TCRA
Resource Conservation And Recovery Act (RCRA): Hazardous Waste Management	42 U.S.C. §§6921 et seq. (implementing regulations at 40 CFR Parts 260 – 268)	RCRA is intended to protect human health and the environment from the hazards posed by waste management (both hazardous and nonhazardous). RCRA also contains provisions to encourage waste reduction. RCRA Subtitle C and its implementing regulations contain the Federal requirements for the management of hazardous wastes.	This requirement would apply to certain activities if the affected sediments contain RCRA listed hazardous waste or exhibit a hazardous waste characteristic. RCRA requirements are applicable only if waste is managed (treated, stored, or disposed of) after effective date of RCRA requirement under consideration or if CERCLA activity constitutes treatment, storage, or disposal as defined by RCRA. Preliminary characterization of the sludge and sediment indicates that they are not listed hazardous waste, do not contain listed hazardous waste, and would not meet any of the characteristics of hazardous waste. Therefore, the RCRA rules for hazardous waste are neither applicable nor relevant and appropriate.	No
RCRA: General Requirements for Solid Waste Management	42 U.S.C. §§6941 et seq. (implementing regulations at 40 CFR 258)	Requirements for construction for municipal solid waste landfills that receive RCRA Subtitle D wastes, including industrial solid waste. Requirements for run-on/run-off control systems, groundwater monitoring systems, surface water requirements, etc.	<p>This requirement would be relevant if a landfill was constructed for the disposal of non-hazardous solid waste. There are no specific Federal requirements for nonhazardous waste management; state regulations provide specific applicable requirements for siting, design, permitting, and operation of landfills.</p> <p>The proposed activity does <u>not</u> involve construction of a landfill.</p>	No
Clean Air Act (CAA)	42 U.S.C. §§7401 et seq.	Potentially applicable if dredging and/or excavation activities generate air emissions sufficient to require a permit, greater than 10 tons of any pollutant per year under the CAA operational permit (USEPA 2009).	TCRA implementation is unlikely to trigger an operational permit.	No
Rivers And Harbors Act of 1899: Obstruction of navigable waters (generally, wharves; piers, etc.); excavation and filling-in	33 U.S.C. §401	Controls the alteration of navigable waters (i.e., waters subject to ebb and flow of the tide shoreward to the mean high water mark). Activities controlled include construction of structures such as piers, berms, and installation of pilings as well as excavation and fill. Section 10 may be applicable for any action that may obstruct or alter a navigable waterway.	No permit is required for on-site activities. However, substantive requirements might limit in-water construction activities.	Yes
Endangered Species Act	16 U.S.C. §§ 1531 et seq.	Federal agencies must ensure that actions they authorize, fund, or carry out are not likely to adversely modify or destroy critical habitat of endangered or threatened species. Actions authorized, funded, or carried out by federal agencies may not jeopardize the continued existence of endangered or threatened species as well as adversely modify or destroy their critical habitats.	If Federally listed threatened or endangered (T&E) species or their critical habitat are present on the site or utilize areas in the vicinity of the site, this requirement is potentially relevant to determination of cleanup areas/volumes, preliminary remediation goals, and determination of removal alternatives. Based on review of USFWS and NMFS maps, no critical habitat is present at the site. Based on a review of photos and aerial images of the site and lists of federal T&E species and their habitats, it is unlikely that T&E species are present at the site. NMFS includes endangered sea turtles in Trust resources impacted by contaminated surface water and sediments that may have been transported from the site. A qualified biologist will perform a site visit prior to construction to confirm the absence of T&E species and critical habitat. Pursuant to CERCLA 121(e) and USEPA policy, separate consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) is not required and permits are not required. USEPA will consult with the resource agencies.	Unlikely

Potential ARARs ¹	Citation	Summary	Comment	Relevance to TCRA
Fish and Wildlife Coordination Act	16 U.S.C. §§661 et seq., 16 U.S.C. §742a, 16 U.S.C. § 2901	Requires adequate provision for protection of fish and wildlife resources. This title has been expanded to include requests for consultation with USFWS for water resources development projects (Mueller 1980). Any modifications to rivers and channels require consultation with the USFWS, Department of Interior, and state wildlife resources agency ³ . Project-related losses (including discharge of pollutants to water bodies) may require mitigation or compensation.	Applicable to any action that controls or modifies a body of water.	Yes
Bald and Golden Eagle Protection Act	16 U.S.C. §668a-d	Makes it unlawful to take, import, export, possess, buy, sell, purchase, or barter any bald or golden eagle, nest, or egg. “Take” is defined as pursuing, hunting, shooting, poisoning, wounding, killing, capturing, trapping and collecting, molesting, or disturbing.	This requirement is potentially relevant to CERCLA activities. No readily available information suggests bald or golden eagles frequent the project area; however, a qualified biologist will perform a site visit prior to construction to confirm that bald and golden eagles do not frequent the project area.	Unlikely
Migratory Bird Treaty Act	16 U.S.C. §§703-712 (implementing regulations at 50 CFR §10.12)	Makes it unlawful to take, import, export, possess, buy, sell, purchase, or barter any migratory bird. “Take” is defined as pursuing, hunting, shooting, poisoning, wounding, killing, capturing, and trapping and collecting.	This requirement is potentially relevant to CERCLA activities. No readily available information suggests migratory birds frequent the project area, and aerial photography of the site suggests no suitable nesting or stopover habitat is present; however, a qualified biologist will perform a site visit prior to construction to confirm that migratory birds do not frequent the project area...	Unlikely
Coastal Zone Management Act	16 USC §§1451 et seq. (implementing regulations at 15 CFR 930)	Federal activities must be consistent with, to the maximum extent practicable, State coastal zone management programs. Federal agencies must supply the State with a consistency determination (USEPA 1989).	The San Jacinto River lies within the Coastal Zone Boundary according to the Texas Coastal Management Plan (TCMP) prepared by the General Land Office (GLO). If a CERCLA activity will affect (adversely or not) the coastal zone, the lead agency is required to determine whether the activity will be consistent with the State’s CZMP (USEPA 1989). More information regarding the state requirements is provided under Texas Coastal Coordination Council (TCCC) Policies for Development in Critical Areas.	Yes
FEMA (Federal Emergency Management Agency), Department of Homeland Security (Operating Regulations)	42 U.S.C. 4001 et seq. (implementing regulations at 44 CFR Chapter 1)	Prohibits alterations to river or floodplains that may increase potential for flooding.	This requirement is relevant to CERCLA activities in upland floodplains and in the river because the project area is within a designated flood zone.	Yes

³ Texas Parks and Wildlife Department.

Potential ARARs ¹	Citation	Summary	Comment	Relevance to TCRA
National Flood Insurance Program (NFIP) Regulations	42 U.S.C. subchapter III, §§4101 et seq.	Provides federal flood insurance to local authorities and requires that the local authorities not allow fill in the river that would cause an increase in water levels associated with floods.	A hydrologic evaluation was performed to determine that the placement of the cap will have no significant impact on the water level during a flood.	Yes
Title 40: Protection of the Environment - Statement of Procedures on Floodplain Management and Wetlands Protection	40 CFR Part 6 App. A; Executive Orders (EO) 11988 and 11990	<p>Requires federal agencies to conduct their activities to avoid, if possible, adverse impacts associated with the destruction or modification of wetlands and occupation or modification of floodplains. Executive Orders 11988 and 11990 require federal projects to avoid adverse effects and minimize potential harm to wetlands and within flood plains.</p> <p>The EO 11990 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative (USEPA 1994).</p>	<p>This requirement is potentially relevant to disposal or treatment activities in the upland as well as any in-water facilities that might displace floodwaters. The waste pits are located within the floodway and Zone AE, or the 1% probability floodplain.</p> <p>Effects on the base flood, typically the 100-year or 1% probability flood, should be minimized to the maximum extent practicable (Code of Federal Regulations 1985 as amended).</p> <p>The agency also adopted a requirement that the substantive requirements of the Protection of Wetlands Executive Order must be met (USEPA 1994). Unavoidable impacts to wetlands must be mitigated (USEPA 1994) ⁴</p>	Yes
National Historic Preservation Act	<p>16 U.S.C. § 470 et seq.</p> <p>(implementing regulations at 36 CFR 800)</p>	Section 106 of this statute requires Federal agencies to consider effects of their undertakings on historic properties. Historic properties may include any district, site, building, structure, or object included in or eligible for the National Register of Historic Places (NRHP), including artifacts, records, and material remains related to such a property.	<p>This requirement is potentially relevant to some invasive investigation activities and remediation activities outside of the TCRA. If there are changes to planned ground disturbance, it may apply to the TCRA.</p> <p>According to the San Jacinto Waste Pit Remedial Investigation/Feasibility Study (RI/FS) cultural resources assessment, “no NRHP-eligible properties are documented in the area if concern. Because of the extensive disturbance to the Site and minimal ground disturbance that will likely occur for the project, it is not likely that NRHP-eligible historic properties will be affected by RI/FS or eventual Site remediation activities” (Anchor QEA 2009).</p>	Unlikely
Noise Control Act	<p>42 U.S.C. §§ 4901 et seq.</p> <p>(implementing regulations at 40 CFR Subchapter G §201 et seq.</p>	Noise Control Act remains in effect but unfunded (USEPA 2010).	Noise is regulated at the state level. See Texas Penal Code under state ARARs.	Possible
Hazardous Materials Transportation Act	<p>49 U.S.C. §§1801 et seq.</p> <p>(implementing regulations at 49 CFR. Subchapter C)</p>	Establishes standards for packaging, documenting, and transporting hazardous materials.	This requirement would apply if hazardous materials are transported off-site for treatment or disposal.	Possible

⁴ Each agency is expected to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands when implementing actions such as CERCLA sites (President of the United States 1977). If §404 of the Clean Water Act is considered an ARAR, then the 404(b)(1) guidelines established in a Memorandum of Understanding (MOU) between USEPA and Department of Army should be followed (USEPA 1994). When habitat is severely degraded, a mitigation ratio of 1:1 may be acceptable (USEPA 1994). However, any mitigation would be at the discretion of the agency and the USEPA may elect to orient mitigation towards “minimizing further adverse environmental impacts rather than attempting to recreate the wetlands original value on site or off site” (USEPA 1988).

Potential ARARs	Citation	Summary	Comment	Relevance to TCRA
State				
30 Texas Administrative Code (TAC) Part 1: Industrial Solid Waste and Municipal Hazardous Waste General Terms	30 TAC §§335.1 – 335.15	General Terms: Substantive requirements for the transportation of industrial solid and hazardous wastes; requirements for the location, design, construction, operation, and closure of solid waste management facilities.	Guidelines to promote the proper collection, handling, storage, processing, and disposal of industrial solid waste or municipal hazardous waste in a manner consistent with the purposes of Texas Health and Safety Code, Chapter 361. Solid nonhazardous waste provisions are applicable if material is transported to an upland disposal facility.	Yes
30 TAC Part 1: Industrial Solid Waste and Municipal Hazardous Waste: Notification	30 TAC Chapter 335 Subchapter P	Requires placement of warning signs in contaminated and hazardous areas if a determination is made by the executive director of the Texas Water Commission a potential hazard to public health and safety exists which will be eliminated or reduced by placing a warning sign on the contaminated property.	Warning signs and fencing were placed around the site in a previous phase of the TCRA.	Yes
30 TAC Part 1: Industrial Solid Waste and Municipal Hazardous Waste: Generators	30 TAC Chapter 335, Subchapter C	Standards for hazardous waste generators either disposing of waste on-site or shipping off-site with the exception of conditionally exempt small quantity generators. The definition of hazardous involves state and federal standards.	<p>This requirement would apply to certain activities if hazardous waste is disposed of on-site or shipped off-site.</p> <p>Preliminary characterization of the sludge and sediment indicates that they are not listed hazardous waste, do not contain listed hazardous waste, and would not meet any of the characteristics of hazardous waste. Therefore, the rules for hazardous waste are neither applicable nor relevant and appropriate.</p>	No
Texas Surface Water Quality Standards	30 TAC §307.4-7, 10	<p>These state regulations provide:</p> <ul style="list-style-type: none">• General narrative criteria• Anti-degradation Policy• Numerical criteria for pollutants• Numerical and narrative criteria for water-quality related uses (e.g., human use)• Site specific criteria for San Jacinto basin	Surface water quality standards are potentially relevant to the determination of risks, but should not override any site-specific toxicity values or risks determined through the risk assessment process. It is also relevant to the identification of potential sources and the short-term and long-term effectiveness of removal alternatives.	Yes
Texas Water Quality: Pollutant Discharge Elimination System (TPDES)	30 TAC §279.10	Stormwater discharge permit for either industrial discharge or construction-related discharge. The State of Texas was authorized by USEPA to administer the NPDES program in Texas on September 14, 1998 (Texas Commission on Environmental Quality 2009).	May be potentially applicable to point-source discharges	Possible
Texas Water Quality: Water Quality Certification	30 TAC §279.10	Establishes procedures and criteria for applying for, processing, and reviewing state certifications under CWA, §401. It is the purpose of this chapter, consistent with the Texas Water Code and the federal CWA, to maintain the chemical, physical, and biological integrity of the state's waters	This citation contains the standards for issuing a Water Quality Certification in Texas, which would be triggered by Section 404 of the CWA. Although permits are not required for on-site CERCLA actions, water quality certification is relevant as part of identification of substantive state ARARs (EPA, 1988).	Yes

Potential ARARs	Citation	Summary	Comment	Relevance to TCRA
Texas Risk Reduction Program	30 TAC §350	Activated upon release of Chemicals of Concern (COC). The Risk Reduction Program uses a tiered approach incorporating risk assessment techniques to help focus investigations, to determine appropriate protective concentration levels for human health, and when necessary, for ecological receptors. Includes protective concentration levels.	Risk assessment will be performed as part of the remedial investigation, and permanent risk reduction will be accomplished through the remedial action; it is outside the scope of the TCRA. The scope of the TCRA is to address the release specifically identified in the EPA Action Memorandum.	No
Natural Resources Code, Antiquities Code of Texas	Texas Parks and Wildlife Commission Regulations 191.092-171	Requires that the Texas Historical Commission staff review any action that has the potential to disturb historic and archeological sites on public land. Actions that needs include any construction program that takes place on land owned or controlled by a state agency or a state political subdivision, such as a city or a county. Without local control, this requirement does not apply.	Assessment of historical resources produced no known eligible properties and determined that disturbance of any archaeological or historic resources is unlikely within the TCRA, depending on the magnitude and specific boundaries of ground disturbance, but may apply to invasive investigation and CERCLA activities outside of the TCRA. (Anchor QEA 2009).	No
Practice and Procedure, Administrative Code of Texas	13 TAC Part 2, Chapter 26	Regulations implementing the Antiquities Code of Texas. Describes criteria for evaluating archaeological sites and permit requirements for archaeological excavation.	This requirement is only applicable if an archaeological site is found.	Unlikely
State of Texas Threatened and Endangered Species Regulations	31 TAC 65.171 - 65.176	No person may take, possess, propagate, transport, export, sell or offer for sale, or ship any species of fish or wildlife listed as threatened or endangered.	No readily available information suggests endangered or threatened species in the project area. NMFS includes endangered sea turtles in Trust resources impacted by contaminated surface water and sediments likely transported from the site. Recommend that presence/absence of state T&E species be documented through biologist site visit.	Unlikely
TCCC Policies for Development in Critical Areas	31 TAC §501.23	Dredging in critical areas is prohibited if activities have adverse effects or degradation on shellfish and/or jeopardize the continued existence of endangered species or results in an adverse effect on a coastal natural resource area (CNRA) ⁵ ; prohibit the location of facilities in coastal natural resource areas unless adverse effects are prevented and /or no practicable alternative. Actions should not be conducted during spawning or nesting seasons or during seasonal migration periods. Specifies compensatory mitigation.	Relevant and appropriate for removal of any contaminated soils or sediments and effects on Coastal Natural Resource Area (CNRAs), which includes coastal wetlands (Railroad Commission of Texas n.d.).	Possible
Texas Coastal Management Plan Consistency	31 TAC, §506.12	Specifies Federal actions within the CMP boundary that may adversely affect CNRAs; specifically selection of remedial actions.	The San Jacinto River lies within the Coastal Zone Boundary (GLO TCMP). If a CERCLA activity will affect (adversely or not) the coastal zone, the lead agency is required to determine whether the activity will be consistent with the State’s CZMP (USEPA 1989).	Yes

⁵ A CNRA is a coastal wetland, oyster reef, hard substrate reef, submerged aquatic vegetation, tidal sand, or mud flat.

Texas State Code – obstructions to navigation	Natural Resources Code § 51.302. Prohibition and Penalty	Prohibits construction or maintenance of any structure or facility on land owned by the State without an easement, lease, permit, or other instrument from the State.	This requirement would apply if the cap was to be constructed on state-owned land. Based on a review of parcel maps, the limits of the proposed construction activities, including inundated areas, are restricted to privately owned land.	No
Potential ARARs	Citation	Summary	Comment	Relevance to TCRA
Noise Regulations	Texas Penal Code Chapter 42, Section 42.01	The Texas Penal code regulates any noise that exceeds 85 decibels after the noise is identified as a public nuisance.	Noise abatement may be required if actions are identified as a public nuisance. Due to the isolation of the site, its location adjacent to a freeway with high volumes of traffic during normal working hours, and the industrial nature of the nearest properties, noise from the construction activity is unlikely to constitute a public nuisance. Noise associated with truck traffic to and from the site should be considered.	Possible
Local				
Harris County Floodplain Management Permit ⁶	Regulations of Harris County, Texas for Flood Plain Management	All development occurring within the floodplain of unincorporated Harris County requires a permit from Harris County; provide land use controls necessary to qualify unincorporated areas of Harris County for flood insurance under requirements of the National Flood Insurance Act of 1968, as amended, to protect human life and health (Harris County 2007).	Floodplain management is addressed under the Federal requirements for floodplains.	No

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USFWS, 2010. USFWS Wetland Mapper for National Inventory Map Information. Accessed online at <http://www.fws.gov/wetlands/data/Mapper.html> on June 30.

FIGURES

K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-049.dwg FIG 1-1
Aug 30, 2010 8:51am cdavidson

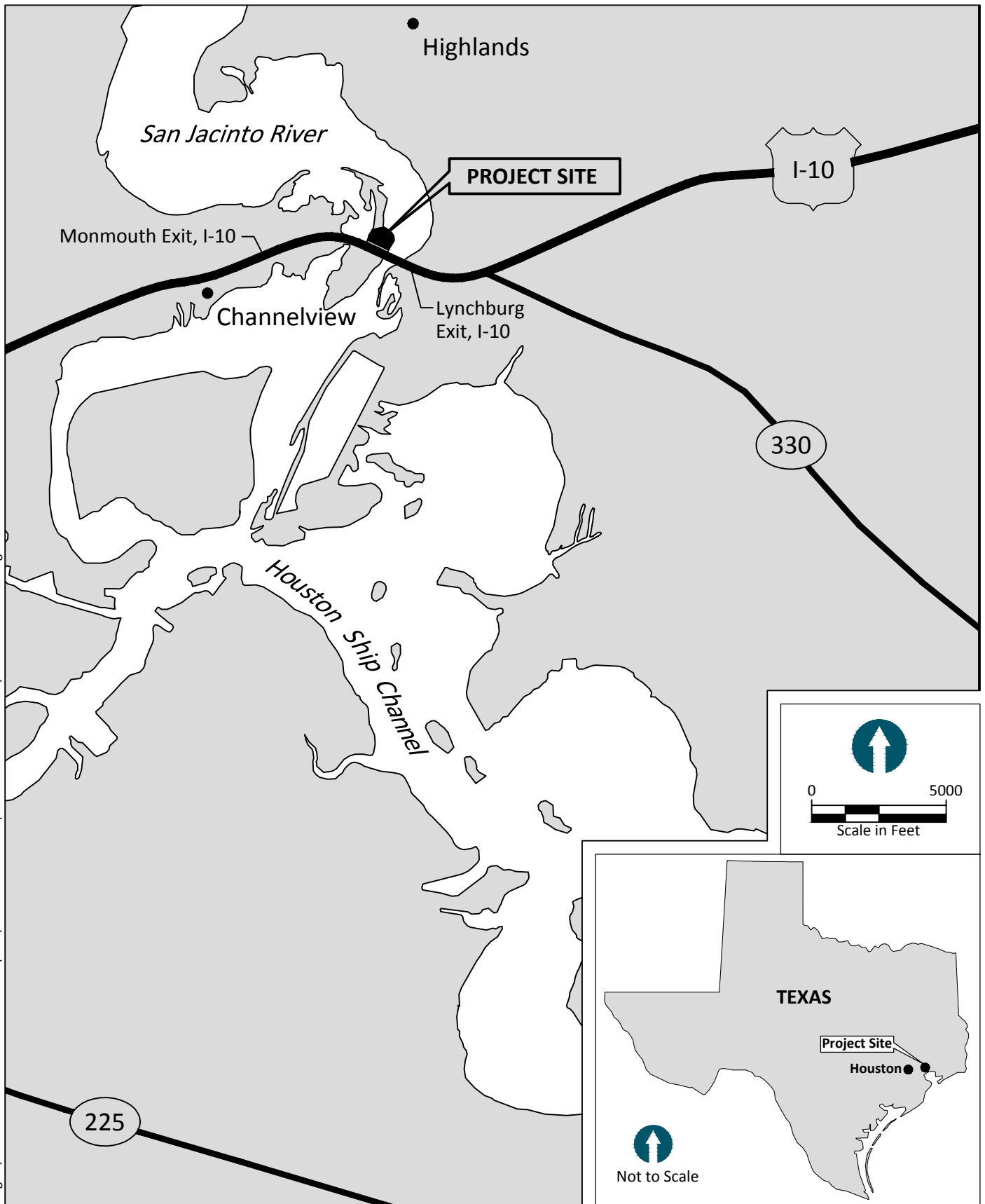
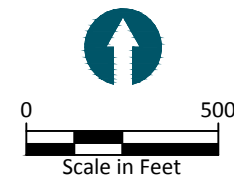


Figure 1-1
Vicinity Map
SJRPW RAWP



SOURCE: Google Map Pro 2009



K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-038.dwg FIG 2-2
Aug 19, 2010 12:48pm cdavidson



LEGEND:

- TCRA Sediment 2, 3, 7, 8-TCDD
Dry Weight and OC Normalized (ng/kg)
- Original (1966) Perimeter of the Impoundments

SOURCE: Aerial Imagery: 0.5-meter
January 2009 DOQOs - Texas Strategic
Mapping Program (StraMap), TNIS

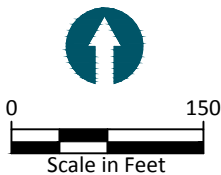
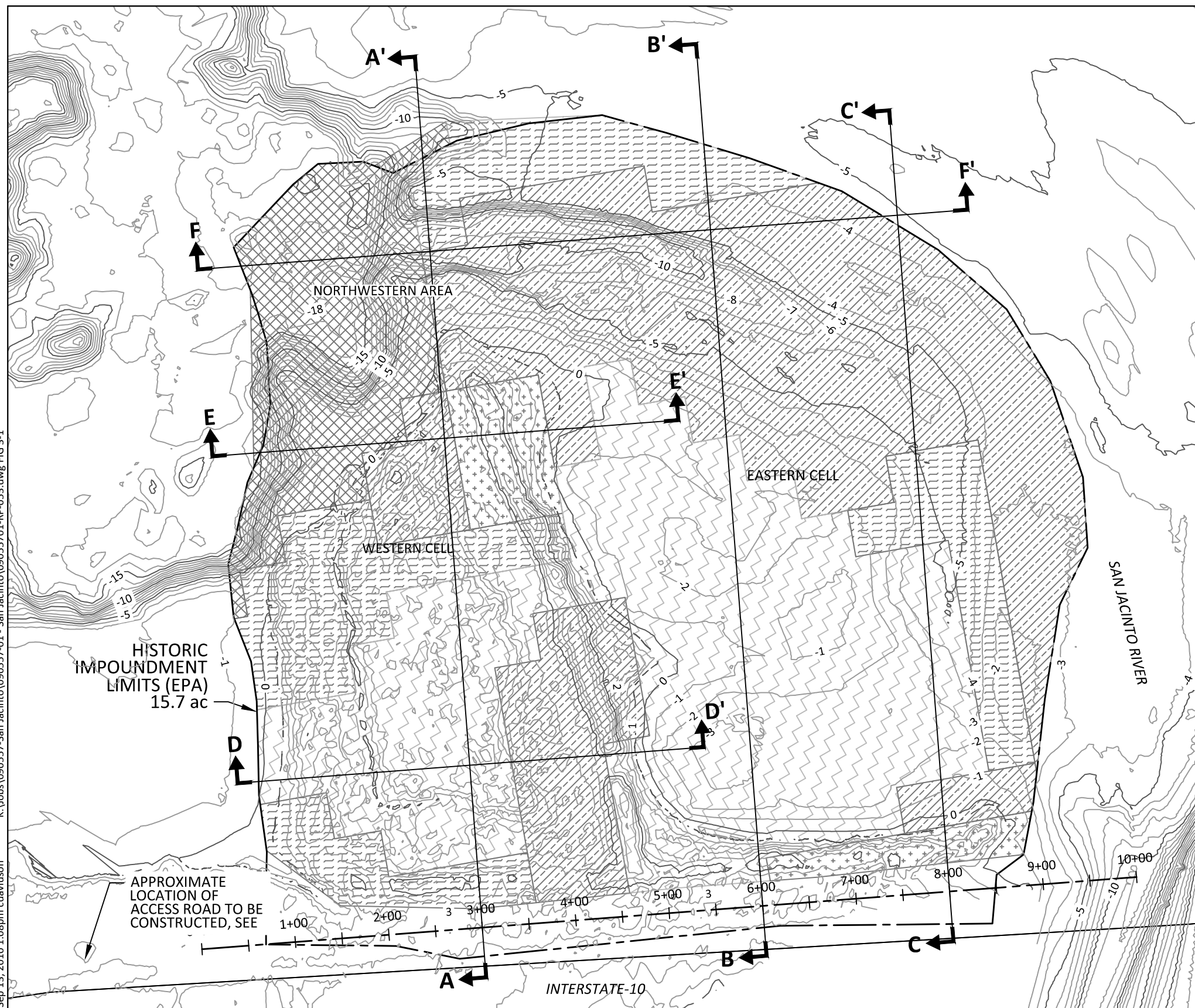









Figure 2-2
2,3,7,8-TCDD Sample Locations
SJRWP RAWP

Sep 13, 2010 1:08pm cdaivison K:\Jobs\090557 San Jacinto\090557-01 - San Jacinto\09055701-RP-053.dwg FIG 3-1

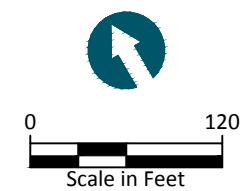


LEGEND:

-  Cross Section Location
-  Existing Contour
-  Armored Cap A
-  Armored Cap B
-  Armored Cap C
-  Armored Cap D
-  Armored Cap E

HORIZONTAL DATUM: Texas South Central, NAD83. US Survey Feet.

VERTICAL DATUM: NAVD88.



K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-054.dwg FIG 3-2
Sep 13, 2010 1:37pm cdauidson

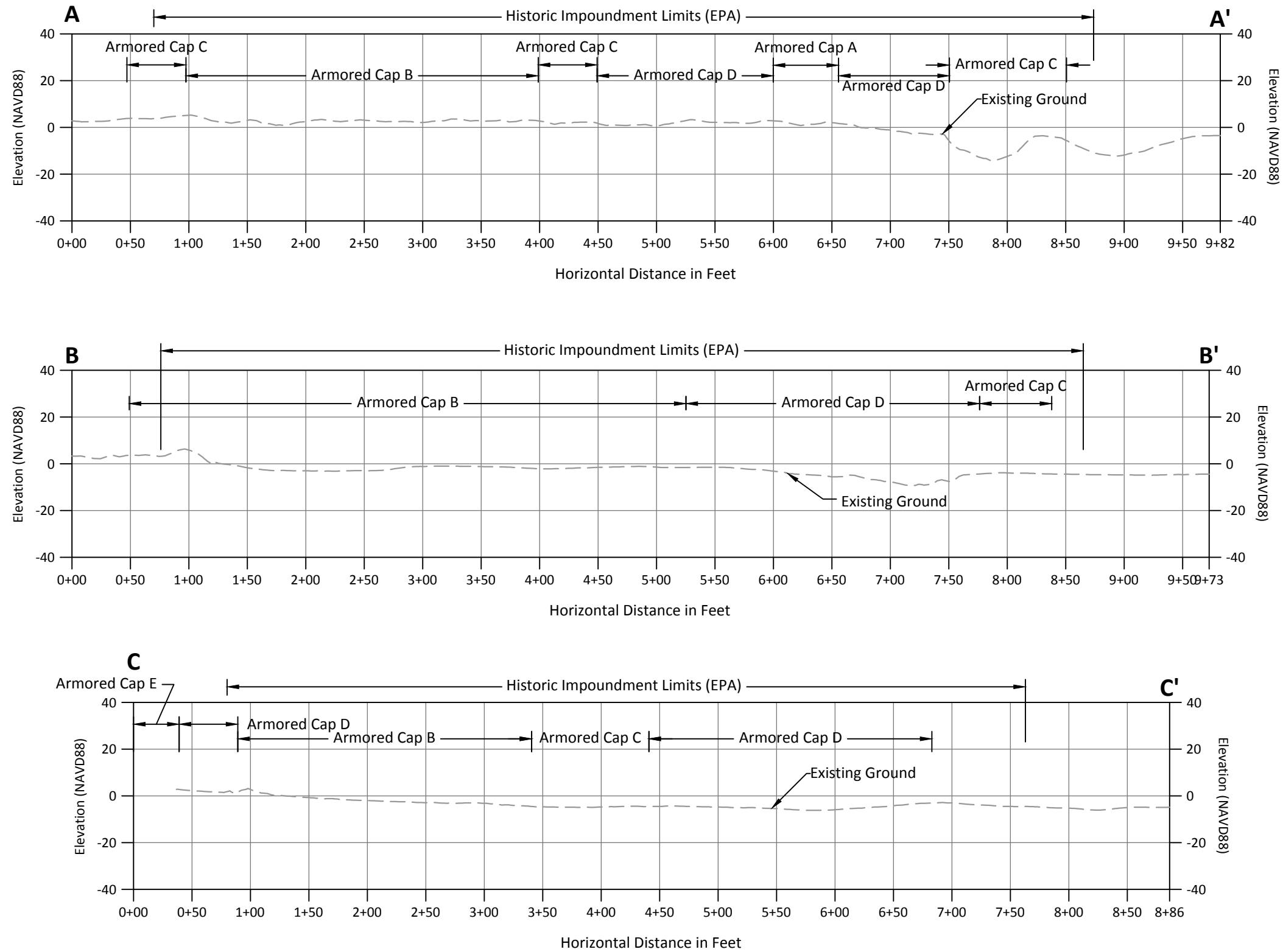
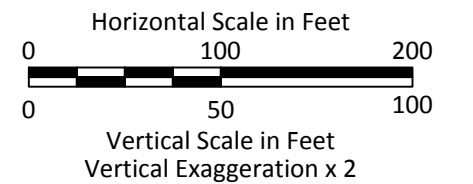
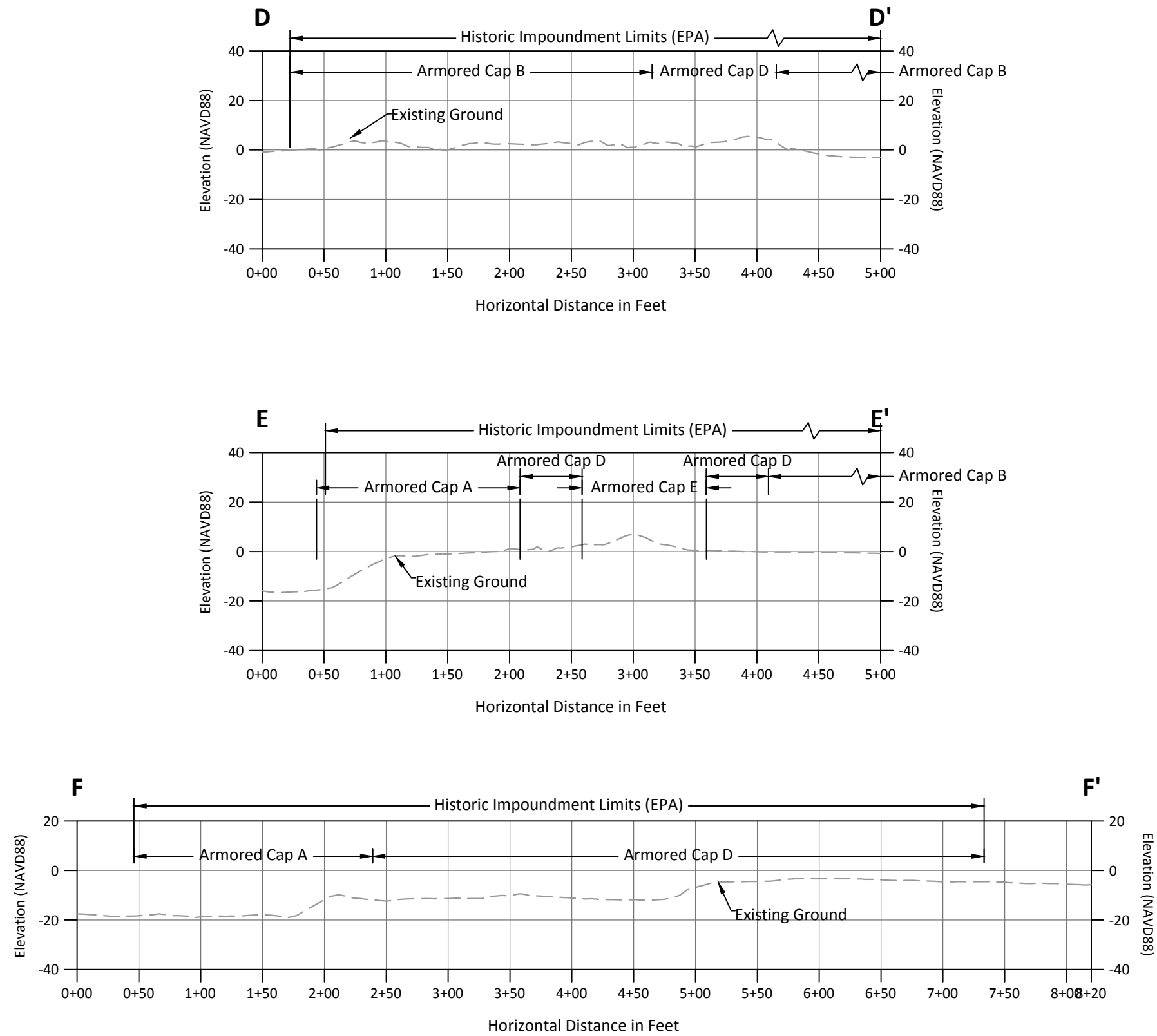


Figure 3-2
Cross Sections (1/2) - TCRA Construction Elements
SJWRP RAWP

K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-054.dwg FIG 3-3
Sep 13, 2010 1:39pm cdauidson



HORIZONTAL DATUM: Texas South Central, NAD83. Us Survey Feet.
VERTICAL DATUM: NAVD88.

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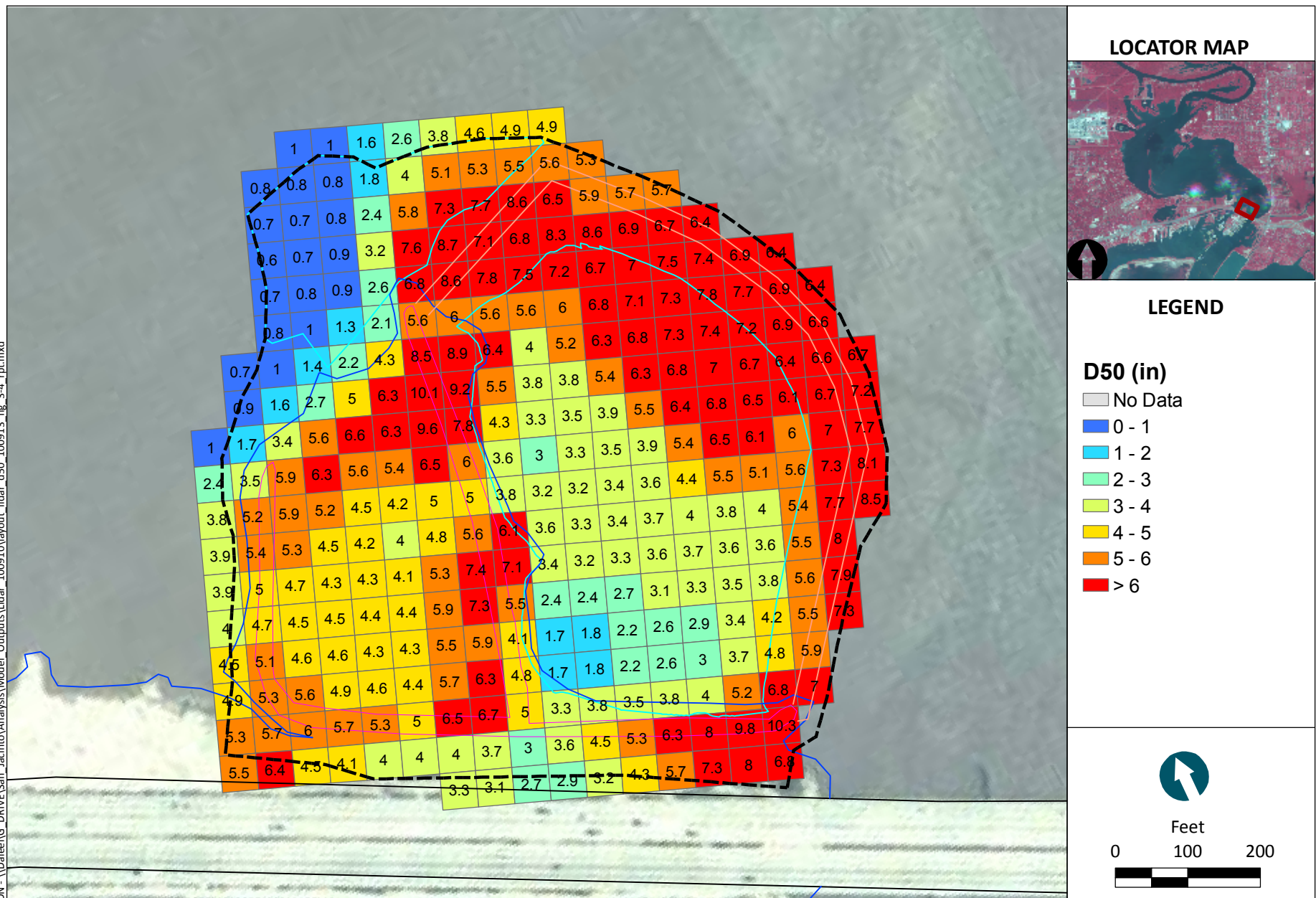
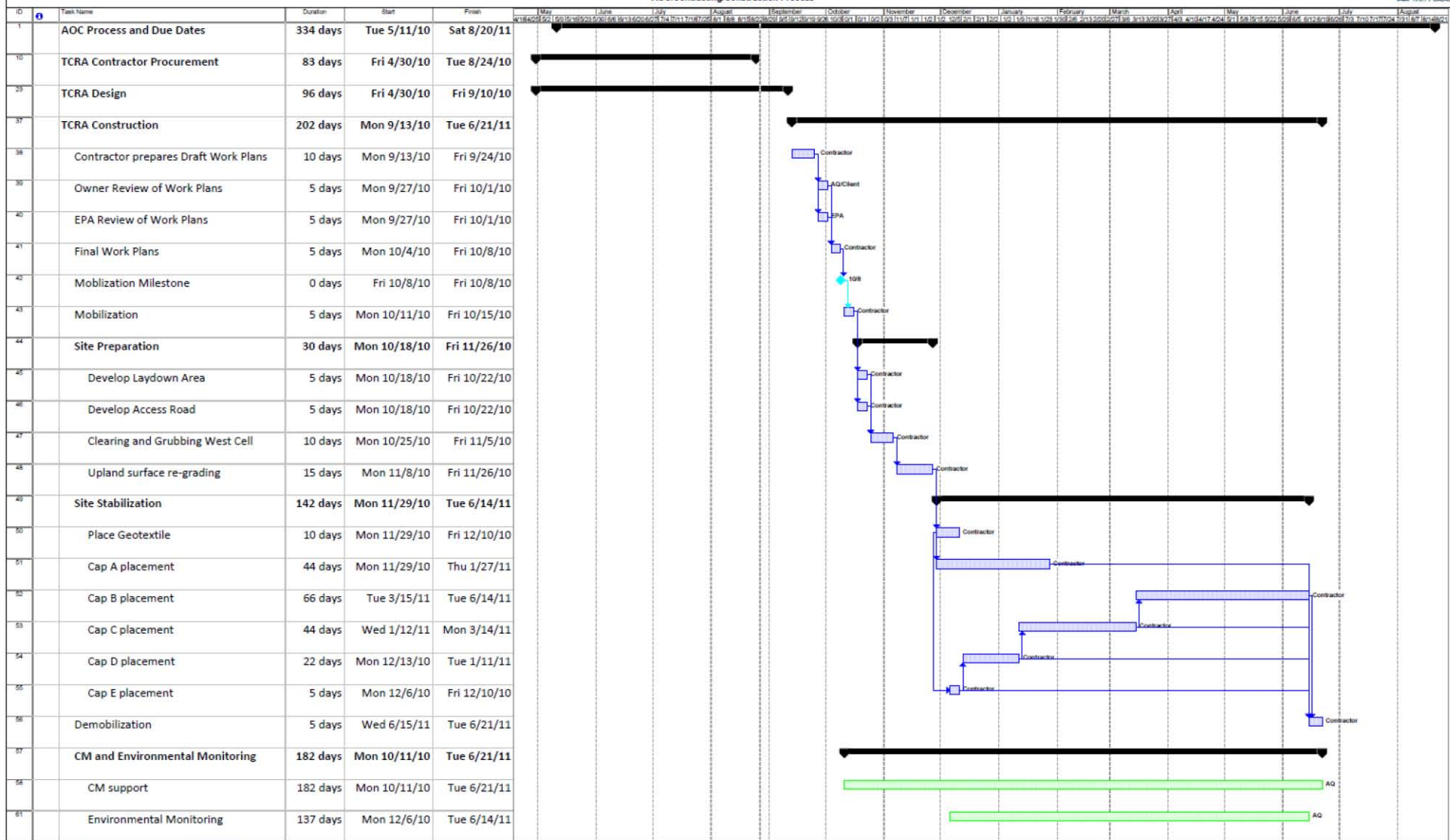


Figure 3-4
Cap Material Gradation Requirements
SJRWP RAWP



APPENDIX A

TECHNICAL SPECIFICATIONS

TIME CRITICAL REMOVAL ACTION

SAN JACINTO RIVER WASTE PITS

SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

John Verduin, PE 83802

Anchor QEA, LLC (F-3617)

September 2010

September 2010

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Attachment A	Standard General Conditions of the Construction Agreement
Attachment B	Reference Drawings

LIST OF ACRONYMS AND ABBREVIATIONS

BMPs	best management practices
CFR	Code of Federal Regulations
CHASP	Contractor health and safety plan
CIH	certified industrial hygienist
CQAP	construction quality assurance plan
CQC	construction quality control
CWP	Contractor work plan
EPP	environmental protection plan
NAD	North American Datum
NAVD 88	North American Vertical Datum of 1988
NTCRA	non-Time Critical Removal Action
RAWP	removal action work plan
RTK	real-time kinematic
Site	San Jacinto River Waste Pits Superfund Site
SSP	Site security plan
TESC	temporary erosion and sedimentation control
TCRA	Time Critical Removal Action
TxDOT	Texas Department of Transportation
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

1.1 TCRA Objectives

The objectives of the Time Critical Removal Action (TCRA) at the San Jacinto River Waste Pits Superfund Site (Site) are to:

- Control erosion of waste materials
- Prevent direct human contact with the waste materials
- Prevent benthic contact with the waste materials

The TCRA will ultimately be part of the overall non-Time Critical Removal Action (NTCRA) or final remedy, which will address the Site and surrounding areas. The time between the TCRA completion and the NTCRA or final remedy is anticipated to be 2 to 7 years.

1.2 Summary of Work

A summary of the work to be performed by the Contractor to complete the TCRA is outlined in these Technical Specifications and includes, but is not limited to, the following:

- Project Set Up
 - Mobilizing and demobilizing all personnel, equipment, supplies, offices, and other facilities necessary for the work.
 - Develop and implement a Site health and safety program.
 - Develop and implement a Site quality control program.
 - Develop and implement a Site security program.
 - Develop and implement an environmental protection program.
 - Conduct in-progress surveys of the work during construction to track progress and adjust cap placement operations as necessary.
 - Construct an access road and laydown area.
- Eastern Cell Protection
 - Implement erosion control measures as shown on Drawings.
 - Grade miscellaneous areas as necessary.
 - Construct an Armored Cap to the extents shown on the Drawings.
- Western Cell Protection

- Clear and grub to the extents shown on the Drawings, removing off-site vegetative material above grade. Smaller roots will be left on-site.
 - Implement erosion control measures as shown on Drawings.
 - Grade miscellaneous areas as necessary.
 - Construct an Armored Cap to the extents shown on the Drawings.
- Northwestern Area Protection
 - Construct an Armored Cap to the extents shown on the Drawings.

1.3 Terms and Conditions

Standard General Conditions of the Construction Agreement are provided as Attachment A.

2 CONSTRUCTION SEQUENCING, TIMING, AND OPERATIONS CONSTRAINTS

2.1 Anticipated Sequencing of Construction

The Contractor shall sequence their work in a manner that minimizes disturbance to other TCRA elements already completed. Work involving material placements shall generally be constructed from the lower elevations upward. Work within intertidal areas shall be sequenced to minimize the potential for erosion.

2.2 Timing

Based on the current schedule, construction activities shall commence within 30 days of United States Environmental Protection Agency (USEPA) approval of the Removal Action Work Plan. The Contractor will develop a project schedule that is subject to review and approval of USEPA. The work shall be completed within 1 year of commencement of construction activities.

2.3 Operations Constraints

The Site is adjacent to the San Jacinto River, Interstate 10, and residential and industrial areas. The Contractor shall be aware of, and follow, regulations related to working adjacent to these areas.

The Contractor shall assume that the Big Star property may be used as a material stockpile and equipment laydown area. Specific locations that are available to the Contractor will be determined at a later date. Excavated materials from the Site shall not be transported to or stored at the Big Star property. As a condition of its use, upon demobilization, the Contractor shall leave the Big Star property in a condition at or better than its current condition. Any improvements made to the Big Star property shall be left in-place upon request of the property owner.

3 CONSTRUCTION ELEMENTS

The TCRA includes the following construction elements, which are described in further detail below:

- Project Set Up
- Armored Cap Construction

Cap construction will consist of both upland and in-water construction of an Armored Cap to protect the Eastern Cell, Western Cell, and Northwestern Area portions of the Site.

3.1 Project Set Up

Project set up includes all activities performed prior to, and in preparation for, TCRA activities and also includes demobilization following the completion and acceptance of construction. This element includes the following tasks:

- Mobilization and demobilization
- Health and safety
- Construction quality control
- Site security
- Environmental protection
- Survey control
- Access road construction
- Big Star property improvements

3.1.1 Mobilization and Demobilization

3.1.1.1 Description of Work

Work shall include costs necessary for mobilizing and demobilizing all personnel, equipment, supplies, offices, and other facilities necessary for the work, surveying, and cleanup. Provide and maintain sanitary facilities in sufficient numbers and at suitable locations for the use of all persons employed on the work. Provide sufficient drinking water for all employees. Mobilization shall consist of pre-construction expenses and costs or preparatory work and operations performed by the Contractor that occur before 10 percent of the Awarded Contract Price is earned from the other respective Bid Items.

Demobilization shall consist of post-construction expenses and work that occurs after 95 percent of the Awarded Contract Price is earned from other Bid Items.

Attachment B provides reference drawings for known utilities that occur on or adjacent to the Site. These drawings are provided for the Contractor's reference only and no representation as to the accuracy of these drawings is implied by their inclusion in the Contract Documents. For purposes of completing the Work, the Contractor shall consider utility identification to be incomplete. The Contractor is responsible for identifying and marking utilities within the work area in accordance with Texas One-Call law, and for protecting utilities throughout the duration of construction activities. The Contractor shall be responsible for any and all damage to any existing utilities caused by the Contractor's efforts.

3.1.1.2 *Materials and Quantities*

Not applicable to this Bid Item.

3.1.1.3 *Assumptions and Restrictions*

Fuel or excess equipment (more than five pieces) shall not be parked on-site. No employee parking is allowed on-site per Texas Department of Transportation (TxDOT) requirements.

3.1.1.4 *Submittals*

The Contractor shall submit a Construction Work Plan (CWP) to Engineer for review and approval prior to mobilization to the Site. The CWP shall include, at a minimum, the following:

- Project schedule
- Proposed subcontractor(s) and their role(s)
- Procedures for identifying below-grade utilities in the work areas
- Proposed equipment and materials
- Methods for mobilizing equipment and materials to the Site
- Source(s) for cap materials, borrow source characterization reports, and analytical results

- Methods for installing the Armored Cap over the eastern Cell
- Methods for clearing and grubbing the western Cell
- Methods of ensuring no tracking of Site soils off-site
- Methods for grading the western Cell
- Methods for installing the Armored Cap over the western Cell
- Methods for installing the Armored Cap over the northwestern Area
- Demobilization
- Additional information as requested elsewhere in these specifications

The Contractor shall provide written notification of intent to commence work a minimum of seven days prior to the Contractor's scheduled date to commence work.

Following the completion of construction, the Contractor shall submit as-built drawings and related documentation to Engineer within 15 days of substantial completion. Contractor shall also submit a copy of its field notes upon request.

3.1.1.5 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.1.2 *Health and Safety*

3.1.2.1 *Description of Work*

The Contractor will be responsible for safety and health for Site workers and the adjacent community during the implementation of the TCRA. The Contractor shall meet all provisions of local, state, and federal safety standards for construction. All Contractor activities shall comply with Hazardous Waste Operation and Emergency Response, 29 Code of Federal Regulations (CFR) 1910.120, where applicable.

The Contractor shall have a Health and Safety Representative, who shall, at a minimum be a Certified Industrial Hygienist (CIH). The Contractor shall also designate a full-time Site

Safety Officer to monitor work efforts, verify that employees of the Contractor and subcontractors are in compliance with the requirements of the Contractor's Health and Safety Plan (CHASP), and determine the need for additional worker protection. All workers shall have the necessary health and safety training needed to comply with work on the Site.

3.1.2.2 *Materials and Quantities*

Not applicable to this Bid Item.

3.1.2.3 *Submittals*

The Contractor shall submit a Contractor Health and Safety Plan (CHASP) to Engineer for review. The CHASP shall be prepared in accordance with the requirements of 29 CFR 1910.120 and 29 CFR 1926.65, and all other applicable OSHA regulations and published guidelines. The CHASP shall clearly define health and safety requirements for specific Site activities. The CHASP shall include employee training and medical certificates as appropriate.

The Contractor shall submit to Engineer amendments to the CHASP as appropriate throughout the duration of the Work. Activities related to the CHASP amendment shall not begin until the amendment has been submitted and reviewed.

3.1.2.4 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.1.3 *Quality Control*

3.1.3.1 *Description of Work*

The Contractor shall establish a Quality Control Program to perform inspection and testing of all items of work required by the specifications, including those performed by subcontractors. As part of this program, the Contractor shall establish, provide, and maintain

a Construction Quality Control (CQC) Plan. The Contractor shall also establish a CQC Supervisor. Daily CQC reports shall be submitted each day for the previous day's activities. Equipment and materials necessary for the CQC Plan shall be considered incidental to the different construction elements.

3.1.3.2 *Materials and Quantities*

Not applicable to this bid item.

3.1.3.3 *Submittals*

Contractor shall submit a Construction Quality Control (CQC) Plan to Engineer for review and approval. The CQC Plan shall detail the methods and procedures that will be taken to ensure that all materials and completed construction elements conform to contract Drawings, technical specifications, and other requirements, whether these elements be manufactured by the Contractor or procured from subcontractors or vendors. The CQC Plan shall specify the name and qualifications of the Contractor's proposed CQC Supervisor.

Daily CQC reports shall be submitted to Engineer each day for the previous day's activities. Daily CQC reports shall be submitted by noon on the following work day. Daily quantities of materials delivered to the Site, and quantities of materials graded and placed, shall be submitted in the daily CQC reports.

3.1.3.4 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.1.4 *Site Security*

3.1.4.1 *Description of Work*

The Contractor shall be responsible for providing Site security during all construction activities, both during working and non-working hours. The primary intent of Site security

measures shall be to restrict access to remedial work areas at the Site as necessary. Those workers entering remedial areas shall have appropriate training as defined in the CHASP. The security measures are also intended to prevent exposure of the public and non-authorized personnel to Site contaminants, and to minimize the incidence of Site theft. As part of this program, the Contractor shall establish, provide, and maintain a Site Security Plan (SSP) and enforce compliance with its provisions by all Contractor and subcontractor employees.

The Contractor shall maintain a daily log of visitors to the Site and make available to the Engineer on request. The visitor's log shall include date, name, address, company employed by, time in and time out, and a record of deliveries. Security breaches or incidents shall also be recorded on the visitor's log.

3.1.4.2 *Materials and Quantities*

Not applicable to this Bid Item.

3.1.4.3 *Assumptions and Restrictions*

The Contractor may make no claim against the Owner or Engineer for damage resulting from trespass.

3.1.4.4 *Submittals*

The Contractor shall submit a Site Security Plan (SSP) to Engineer for approval, detailing the methods and procedures that will be taken to ensure that the Site is secured during working and non-working hours.

3.1.4.5 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.1.5 *Environmental Protection*

3.1.5.1 *Description of Work*

The Contractor shall establish an Environmental Protection Program that prevents environmental pollution, establishes temporary erosion and sedimentation controls (TESCs), and minimizes environmental degradation during, and as a result of, construction operations. The control of environmental pollution requires consideration of noise levels, air, water, and land.

This task should include costs for preparation of an Environmental Protection Plan (EPP), costs for purchase, installation, and maintenance of silt fences, silt curtains, and other measures identified in the EPP, and costs for inspections of installed environmental protection measures. The task shall also include costs to prevent the off-site transport of materials on equipment leaving the Site.

3.1.5.2 *Materials and Quantities*

A silt fence shall be constructed around all upland construction activities. A silt curtain shall be installed around all in-water construction activities. The silt curtain shall be supported by floats at the top and weighted at the bottom. The silt curtain bottom shall be within 3 feet of the mudline at all times.

The Contractor shall install a Temporary Erosion Control Berm as shown on the Drawings. The intention of the berm is to control erosion of surface materials with the rising and falling of the tide and San Jacinto river levels. Temporary silt fences shall be installed around the perimeter of the construction area to minimize erosion of exposed soils into the river.

The Contractor shall purchase and install four signs offshore at the outer edges of the Site notifying mariners to stay out of the area.

3.1.5.3 *Assumptions and Restrictions*

The Contractor can assume that the Engineer will perform all water quality monitoring during in-water activities. If water quality exceedances occur during material placement, Contractor shall be responsible for adjusting its operations or environmental protection

controls as necessary to achieve water quality monitoring results in compliance with relevant standards. Contractor shall not be paid standby time if operations must be temporarily suspended due to water quality monitoring results in exceedance of relevant standards.

3.1.5.4 Submittals

The Contractor shall submit an Environmental Protection Plan (EPP) to Engineer for approval, which shall establish and maintain quality control for environmental protection of all items of the TCRA. At a minimum, the EPP shall include the following information:

- Proposed materials and methods to control erosion and turbidity
- Description of procedures for prompt maintenance and repair of installed erosion and turbidity controls
- Sheen and floating debris control measures
- Description of control procedures to decontaminate trucks importing fill material prior to the trucks leaving the Site (e.g., inspecting and brushing off visible dirt, wheel washing)
- Description of methods to decontaminate any equipment leaving the Site.
- Description of measures to minimize wheel contact of trucks entering and leaving the Site with the exposed subgrade
- Site planning showing the location of TESC measures
- Fueling plan
- Emergency procedures to respond to a fuel spill on land or over water
- Methods to control dust for access road and other areas of the Site
- Description of best management practices that will be used to prevent or minimize stormwater from being exposed to pollutants from spills, cleaning and maintenance activities, and waste handling activities, including fuel, hydraulic fluid, and other oils from vehicles and machinery
- Projected date when TESC measures will be in place
- Projected date of removal of TESC structures (after soil is stabilized by vegetation or other means)

Any requested changes or modifications to the TESC measures shown on the Drawings shall be submitted in writing to the Engineer for approval prior to implementation.

3.1.5.5 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.1.6 *Survey Control*

3.1.6.1 *Description of Work*

An accurate method of horizontal and vertical control shall be established by the Contractor before work begins. The Contractor shall lay out its work from horizontal and vertical control points indicated on the figures and shall be responsible for all measurement taken from these points.

Accuracy for topographic surveys completed for upland work shall be to the nearest 0.01-foot ± 0.005 -foot for elevation and to ± 0.1 -foot for horizontal distance.

The Contractor shall establish and maintain a tide gauge or board in a location where it may be clearly seen during in-water work. The Contractor shall employ a suitable method to locate and control horizontal and vertical in-water work. The Contractor is required to have real-time kinematic (RTK) controls for survey control work. Accuracy for measured depths for in-water work shall be ± 0.25 foot; accuracy of horizontal positions shall be ± 3 feet at the 95 percent confidence interval.

The Contractor shall safeguard all survey control points. Should any of these points be damaged or destroyed, the Contractor shall replace the control point at no cost to the Owner or Engineer. The Contractor shall assume the entire expense of rectifying work improperly constructed due to failure to maintain and protect established survey control points.

3.1.6.2 *Materials and Quantities*

Not applicable to this bid item.

3.1.6.3 *Assumptions and Restrictions*

The horizontal datum shall be Texas South Central, North American Datum (NAD) of 1983. The vertical datum shall be NAVD 1988 (2001 Adjusted).

The Contractor can assume that the Engineer will be responsible for all pre- and post-activity payment surveys.

3.1.6.4 *Submittals*

As part of the Contractor's CWP, Contractor shall provide description of proposed survey equipment, qualifications of survey crew, and proposed survey control methods.

The Contractor shall provide cross sections of the installed work every two days during both in-water and upland work. The volume of material placed and the area affected shall also be determined every two days. The cross sections and volume calculation shall be submitted as part of the Daily CQC report by noon on the following work day.

Field notes shall be recorded during each survey event. Notes shall include weather conditions, equipment calibration records, time and date of measurements, surface water elevation measurements, surface water elevation, surface water conditions, etc. Contractor shall submit a copy of the survey field notes to the Engineer at the conclusion of construction.

If Contractor installs or replaces survey monuments during the completion of the work, Contractor shall provide a sealed survey of the monuments and verification that the survey was recorded in Harris County within 15 days following the completion of work.

3.1.6.5 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.1.7 *Access Road Construction*

3.1.7.1 *Description of Work*

Access road construction shall be to the limits shown on the Drawings. The subgrade shall be cleared of vegetation and leveled prior to the road construction. A separation geotextile shall be placed over the cleared and leveled subgrade prior to placing aggregate. Geotextile panels shall overlap by a minimum of 2 feet. After completion of the TCRA, the access roads shall remain in place.

3.1.7.2 *Materials and Quantities*

The access road shall be a minimum of 12 feet wide and in the general location shown on the Drawings. The road section shall be constructed of 12 inches of TxDOT Item 247, Grade 1 (Texas Department of Transportation 2004 Standard Specifications) over a separation geotextile of Mirafi 160N or equivalent.

3.1.7.3 *Assumptions and Restrictions*

Assume that no additional fill materials will be required to create manageable grades, nor will excess soils have to be removed. Vegetation above the subgrade removed as part of the activities shall be removed from the Site and properly disposed. Any soil adhering to vegetation root wads that have been removed as part of grubbing shall be removed from the root wads and placed evenly within the Western Cell prior to Armor Cap construction.

3.1.7.4 *Submittals*

As part of CWP, include Contractor's proposed borrow source for TxDOT Item 247, Grade 1, and product information for Contractor's proposed separation geotextile.

3.1.7.5 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.1.8 *Big Star Property Improvements*

3.1.8.1 *Description of Work*

Contractor shall make improvements to the Big Star property as deemed necessary by the Contractor for the completion of the TCRA.

3.1.8.2 *Materials and Quantities*

Not applicable.

3.1.8.3 *Assumptions and Restrictions*

Assume that no structures currently existing at the Big Star property may be removed. The Contractor is responsible for identifying and marking utilities at the Big Star property in accordance with Texas One-Call law, and for protecting utilities throughout the duration of construction activities. The Contractor shall be responsible for any and all damage to any existing utilities caused by the Contractor's efforts. All proposed improvements to the Big Star property are subject to the approval of the Engineer and the property owner.

The Contractor shall provide for the duration of the Site work, an on-site field office complex with an office space of not less than 1,000 square feet, for exclusive use of Engineer and Government personnel. The above facility shall be located at the concrete slab located on the Big Star property as shown on the Drawings. The office may be a portable trailer or building. The field office shall be secured in place using tie downs capable of withstanding winds of up to 75 miles per hour. The Contractor shall provide full electric, central Heating Ventilating and Air Conditioning (HVAC) system, water supply, and sewage removal utility services. The Contractor shall be responsible for physical and fire protection, security, repairs from vandalism, and replacements from theft of the office facility and contents. This facility shall be ready for occupancy within 30 days and fully completed within 45 days after acknowledgment of the Notice to Proceed and prior to any on-site construction activities.

3.1.8.4 *Submittals*

As part of CWP, include Contractor's proposed Site improvements for the Big Star property.

3.1.8.5 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.2 *Armored Cap Construction*

The extent of work for the Armored Cap construction is indicated on the Drawings. This element includes the following tasks:

- Clearing and grubbing
- Upland surface grading
- Geotextile placement
- Placement of Armor Cap material

3.2.1 *Clearing and Grubbing*

3.2.1.1 *Description of Work*

Contractor shall cut at the ground surface and remove surface vegetation from the cap areas in preparation for future surface grading and/or cap placement. Roots from vegetation 8 inches in diameter or smaller shall be grubbed and evenly distributed across the Western Cell prior to geotextile placement. The intent is to avoid uneven pockets of vegetative mass under the cap. Roots from vegetation greater than 8 inches in diameter shall be cleared of adhering soil and properly disposed of off-site.

3.2.1.2 *Materials and Quantities*

Not applicable to this Bid Item.

3.2.1.3 *Assumptions and Restrictions*

Contractor shall not pump water from the area to be cleared and grubbed into any surface waters, stream corridors, or wetlands; if water is pumped, it shall be collected and disposed off-site. Disposal of trees, brush, and other debris in any surface waters, stream corridors, wetlands, or at unspecified locations is prohibited. Open fires are not allowed.

3.2.1.4 Submittals

As part of the Contractor's CWP, Contractor shall provide description of equipment and methods proposed to complete the removal of vegetation. Include a description of methods to be employed to decontaminate trucks for hauling vegetation, or methods such as temporary haul roads to be employed to prevent contact between the trucks and paper mill sludge.

As part of the Contractor's CWP, Contractor shall also provide the name and location of the proposed facility for the disposal of removed vegetation.

3.2.1.5 Measurement and Payment

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.2.2 Surface Grading

3.2.2.1 Description of Work

Contractor shall grade the surface of the Site to achieve the surface elevations specified on the Drawings. In addition, some areas of isolated grading may be required after clearing and grubbing are complete. If significant grading is to occur in the Western Cell, prior to commencing surface grading, the Contractor shall install an erosion control structure along the northwest portion of the Western Cell as shown on the Drawings.

3.2.2.2 Materials and Quantities

Contractor shall complete grading using existing earthen material from the perimeter berms surrounding the Western Cell. Based on existing Site topography data, approximately 200 cubic yards of material will require grading to achieve the elevations specified in the Drawings.

3.2.2.3 *Assumptions and Restrictions*

Earthwork for Site grading shall be completed using cut materials from the Site as shown on the Drawings. The intent is to keep all cut material on-site and use it as fill beneath the Armored Cap. If paper mill sludge is encountered during surface grading activities, the Contractor shall notify the Engineer immediately and provide recommendations for completing the surface grading activities while minimizing or eliminating the handling of the paper mill sludge.

The cut material shall be placed in an initial lift resulting in a 24-inch maximum horizontal layer, compacted with at least three passes of crawler-type tractors or power-drive tampers. Subsequent lifts shall be placed in 12-inch maximum horizontal layers and compacted in the same manner.

Contractor shall not pump water from the area to be graded into any surface waters, stream corridors, or wetlands; if water is pumped, it shall be collected and disposed off-site.

Contractor shall employ best management practices (BMPs) for TESC's in the work area to prevent the loss of soil due to natural causes such as storm events, surface water runoff, and wind, and to prevent the introduction of sediment to adjacent wetlands or water bodies.

The final surface elevations for the graded area must be within ± 0.25 foot of the elevations specified on the Drawings.

3.2.2.4 *Submittals*

As part of the Contractor's CWP, Contractor shall provide description of equipment and methods proposed to complete surface grading of the Site, and provide description of TESC's to be employed during surface grading activities.

3.2.2.5 *Measurement and Payment*

This Bid Item will be measured on a lump sum basis. Payment will be made on review and acceptance by Engineer for the total value listed for this Bid Item on the Bid Form. Progress

payments may be made based upon estimated percent complete as requested in Contractor's Application for Payment and approved by Engineer.

3.2.3 *Filter Geotextile*

3.2.3.1 *Description of Work*

Prior to placement of the Armor Cap material, a geotextile shall be placed atop the surface of below the Armored Caps as shown on the drawings. Geotextile panels shall overlap by a minimum of 3 feet. The geotextile shall be placed atop the mud line where grading did not occur. The geotextile shall be placed atop the graded surface in the Western Cell following acceptance of the graded surface by Engineer. The geotextile shall be anchored per manufacturer's recommendations on slopes to prevent creep of the geotextile down slope.

3.2.3.2 *Materials and Quantities*

The Filter Geotextile shall be Mirafi 1120N or equivalent.

3.2.3.3 *Assumptions and Restrictions*

The Contractor shall propose a method to the Engineer that confirms the minimum 3 feet of overlap was obtained and present it in the CWP and CQAP.

Water quality monitoring will be conducted by the Engineer and will occur during in-water activities as described in the Bid Item for Environmental Protection. In-water construction operations shall be adjusted to meet water quality criteria if water quality exceedances occur during geotextile placement. Armored Caps on slopes shall be placed from the toe of the slope upward.

3.2.3.4 *Submittals*

As part of CWP, include product information sheet for Contractor's proposed Filter Geotextile.

3.2.3.5 *Measurement and Payment*

This Bid Item will be measured per square yard of geotextile furnished and installed. The per square yard unit rate shall be extended by the estimated bid quantity to establish a Lump Sum Cost. Square yardage will be measured based on the size of the upland and in-water installation areas; overlapping panel quantities or delivered quantities of geotextile to the Site will not be considered as a basis for measurement and payment.

3.2.4 *Armored Cap Construction*

3.2.4.1 *Description of Work*

The Armored Cap shall be constructed to the extents and thickness shown on the Drawings with the different materials identified on the Drawings. The Armored Cap shall be placed in such a manner to minimize resuspension of sediments or damage to the geotextile. All cap material placed on slopes must be placed from the toe of the slope up towards the crest.

The Contractor shall establish procedures for monitoring the rate of material placement, including the use of a positioning system, and methods for determining the rate of material placed. The Contractor shall also develop quality control/quality assurance methods to monitor placement rates and thickness.

3.2.4.2 *Materials and Quantities*

There are 5 different Armor Cap material gradations as defined below:

- Armor Cap Material A:
 - 80 percent by weight of well graded crushed natural rock with the following gradation requirements:
 - 100% passing 6 inches
 - No more than 50% passing 3 inches
 - No more than 4% passing the #200 sieve
 - 20 percent by weight of gravelly sand with the following gradation requirements:
 - 100% passing 3/8-inch sieve
 - 50% to 90% passing the #4 sieve

- 10% to 40% passing the #10 sieve
 - No more than 4% passing the #200 sieve
- Armor Cap Material B. Well graded crushed natural rock with the following gradation requirements:
 - 100% passing 12 inches
 - No more than 50% passing 5 inches
 - No more than 4% passing the #200 sieve
- Armor Cap Material C. Well graded crushed natural rock with the following gradation requirements:
 - 100% passing 12 inches
 - No more than 50% passing 6 inches
 - No more than 4% passing the #200 sieve
- Armor Cap Material D. Well graded crushed natural rock with the following gradation requirements:
 - 100% passing 18 inches
 - No more than 50% passing 8 inches
 - No more than 4% passing the #200 sieve
- Armor Cap Material E. Well graded crushed natural rock with the following gradation requirements:
 - 100% passing 24 inches
 - No more than 50% passing 12 inches
 - No more than 4% passing the #200 sieve

The Armor Cap materials shall be clean, granular material free of roots, organic material, contaminants, and all other deleterious and objectionable material. Samples will need to be analyzed by the Contractor for the list of analytes in Table 1.

3.2.4.3 *Assumptions and Restrictions*

Use of spuds will not be allowed in areas previously capped.

If the Armor Cap material proposed by the Contractor requires on-site mixing of two or more borrow materials, the Contractor shall be responsible for identifying and maintaining

an on-site area for Armor Cap material mixing and stockpiling. The Contractor shall mix the borrow materials to the satisfaction of the Engineer prior to placement. Contractor's costs for mixing of borrow materials are incidental to the Bid Item.

Water quality monitoring will be conducted by the Engineer and will occur during in-water activities as described in the Bid Item for Environmental Protection. In-water construction operations shall be adjusted to meet water quality criteria if water quality exceedances occur during material placement.

3.2.4.4 *Submittals*

As part of CWP, include Contractor's proposed source for the different Armor Cap materials. Include, at a minimum, the company name, address, and phone number for the proposed source(s), material gradation curves, and laboratory analytical results for the samples analyzed as described in Section 3.2.4.2. For Armor Cap Material A, the Contractor shall submit separate gradation analyses for the crushed rock component, the sand component, and the mixed material and a brief description of proposed methods for blending these materials to achieve the required 80/20 weight ratio of crushed rock to sand.

As part of Contractor's daily CQC report, include a photocopy of weigh tickets for Armor Cap materials transported to the Site. Daily CQC reports shall be submitted by noon on the following work day.

3.2.4.5 *Measurement and Payment*

This Bid Item will be measured per ton of Armored Cap materials furnished and constructed. The per ton unit rate shall be extended by the estimated bid quantity to establish a Lump Sum Cost. Tonnage will be based on weight slips provided by the approved borrow source. The per ton unit rate for Armor Cap materials shall be established for each type of Armored Cap material and for each method of placement, as follows:

- Armor Cap Material A
- Armor Cap Material B
- Armor Cap Material C
- Armor Cap Material D

- Armor Cap Material E

For payment purposes, an overplacement allowance of up to 6 inches will be given to account for the accuracy of placing the material below elevation 2 feet NAVD 88. No overplacement allowance will be given for materials placed above elevation 2 feet NAVD 88. This overplacement allowance is included in the quantity provided in the Bid Table (Table 2).

4 SUMMARY OF SUBMITTALS

A summary of the submittals required by these Technical Specifications is provided in the Construction Quality Assurance Plan (CQAP), which is Attachment E to the RAWP.

5 REFERENCES

Texas Department of Transportation, 2004. Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges. Adopted by the Texas Department of Transportation June 1, 2004.

TABLES

Table 1
Armored Cap Material Analyte List

Parameter	Analytical Method	Reporting Limit (mg/kg)	TCEQ Tier I Residential Soil PCLs ⁽¹⁾ (mg/kg)	TRRP Tier 1 Sediment PCLs ⁽⁴⁾ (mg/kg)	TCEQ Marine PEL ⁽⁵⁾ (mg/kg)	Required Fill Chemical Concentration Criteria (mg/kg)
Metals						
Aluminum	6010B/6020	10	6.4E+04	1.5E+05	NL	6.4E+04
Antimony	6010B/6020	5.0	2.7E+00	8.3E+01	NL	2.7E+00
Arsenic	6010B/6020	5.0	2.5E+00	1.1E+02	4.2E-02	4.2E-02
Cadmium	6010B/6020	0.20	7.5E-01	1.1E+03	4.2E-03	4.2E-03
Chromium	6010B/6020	0.50	1.2E+03	3.6E+04	1.6E-01	1.6E-01
Copper	6010B/6020	0.50	5.2E+02	2.1E+04	1.1E-01	1.1E-01
Lead	6010B/6020	2.0	1.5E+00	5.0E+02	1.1E-01	1.1E-01
Mercury	7471A	0.005	3.9E-03	3.4E+01	7.0E-04	7.0E-04
Nickel	6010B/6020	2.0	7.9E+01	1.4E+03	4.3E-02	4.3E-02
Silver	6010B/6020	0.50	2.4E-01	3.5E+02	1.8E-03	1.8E-03
Zinc	6010B/6020	5.0	1.2E+03	7.6E+04	2.7E-01	2.7E-01
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	8270C	0.10	2.4E+00	1.5E+03	--	2.4E+00
1,2-Dichlorobenzene	8270C	0.10	8.9E+00	6.6E+04	--	8.9E+00
1,3-Dichlorobenzene	8270C	0.10	3.4E+00	2.2E+04	--	3.4E+00
1,4-Dichlorobenzene	8270C	0.10	1.1E+00	2.3E+03	--	1.1E+00
2,4-Dimethylphenol	8270C	0.10	1.6E+00	3.1E+03	--	1.6E+00
2-Methylnaphthalene	8270C	0.10	8.5E+00	2.5E+03	NL	8.5E+00
2-Methylphenol	8270C	0.10	3.6E+00	7.7E+03	--	3.6E+00
4-Methylphenol	8270C	0.10	3.2E-01	7.7E+02	--	3.2E-01
Acenaphthene	8270C	0.10	1.2E+02	7.4E+03	8.9E-02	8.9E-02
Acenaphthylene	8270C	0.10	2.0E+02	7.4E+03	1.3E-01	1.3E-01
Anthracene	8270C	0.10	3.4E+03	3.7E+04	2.5E-01	2.5E-01
Benz[a]anthracene	8270C	0.10	5.6E+00	1.6E+01	6.9E-01	6.9E-01
Benzo[a]pyrene	8270C	0.10	5.6E-01	1.6E+00	7.6E-01	5.6E-01
Benzo[b]fluoranthene	8270C	0.10	5.7E+00	1.6E+01	--	5.7E+00
Benzo[g,h,i]perylene	8270C	0.10	1.8E+03	3.7E+03	--	1.8E+03
Benzo[k]fluoranthene	8270C	0.10	5.7E+01	1.6E+02	--	5.7E+01
Benzoic acid	8270C	0.60	9.5E+01	6.1E+05	NL	9.5E+01
Benzyl alcohol	8270C	0.10	2.9E+00	4.6E+04	NL	2.9E+00
Bis[2-ethylhexyl]phthalate	8270C	0.10	4.3E+01	2.4E+02	--	4.3E+01
Butyl benzyl phthalate	8270C	0.10	1.3E+02	3.1E+04	--	1.3E+02
Chrysene	8270C	0.10	5.6E+02	1.6E+03	8.5E-01	8.5E-01
Dibenz[a,h]anthracene	8270C	0.10	5.5E-01	1.6E+00	1.3E-01	1.3E-01
Diethyl phthalate	8270C	0.10	7.8E+01	1.2E+05	--	7.8E+01
Dimethyl phthalate	8270C	0.10	3.1E+01	1.2E+05	--	3.1E+01
Di-n-butyl phthalate	8270C	0.10	1.7E+03	1.5E+04	--	1.7E+03
Di-n-octyl phthalate	8270C	0.10	1.3E+03	3.1E+03	--	1.3E+03
Fluoranthene	8270C	0.10	9.6E+02	4.9E+03	1.5E+00	1.5E+00
Fluorene	8270C	0.10	1.5E+02	4.9E+03	1.4E-01	1.4E-01
Hexachlorobenzene	8270C	0.10	5.6E-01	8.9E+00	NL	5.6E-01
Hexachlorobutadiene	8270C	0.10	1.6E+00	3.1E+01	--	1.6E+00
Hexachloroethane	8270C	0.10	9.2E-01	1.5E+02	--	9.2E-01
Indeno[1,2,3-c,d]pyrene	8270C	0.10	5.7E+00	1.6E+01	--	5.7E+00
Naphthalene	8270C	0.10	1.6E+01	2.5E+03	3.9E-01	3.9E-01
N-nitrosodiphenylamine	8270C	0.10	1.4E+00	9.0E+02	--	1.4E+00
Pentachlorophenol	8270C	0.20	9.2E-03	5.6E+01	--	9.2E-03

Table 1
Armored Cap Material Analyte List

Parameter	Analytical Method	Reporting Limit (mg/kg)	TCEQ Tier I Residential Soil PCLs ⁽¹⁾ (mg/kg)	TRRP Tier 1 Sediment PCLs ⁽⁴⁾ (mg/kg)	TCEQ Marine PEL ⁽⁵⁾ (mg/kg)	Required Fill Chemical Concentration Criteria (mg/kg)
Phenanthrene	8270C	0.10	2.1E+02	3.7E+03	5.4E-01	5.4E-01
Phenol	8270C	0.10	9.6E+00	9.2E+04	--	9.6E+00
Pyrene	8270C	0.10	5.6E+02	3.7E+03	1.4E+00	1.4E+00
Volatile Organic Compounds (VOCs)						
1,1,1,2-Tetrachloroethane	8260B	0.0050	7.1E-01	2.1E+03	NL	7.1E-01
1,1,1-Trichloroethane	8260B	0.0050	8.1E-01	1.5E+05	--	8.1E-01
1,1,2,2-Tetrachloroethane	8260B	0.0050	1.2E-02	2.7E+02	--	1.2E-02
1,1,2-Trichloroethane	8260B	0.0050	1.0E-02	9.6E+02	--	1.0E-02
1,1-Dichloroethane	8260B	0.0050	9.2E+00	7.3E+04	--	9.2E+00
1,1-Dichloroethene	8260B	0.0050	2.5E-02	9.1E+01	--	2.5E-02
1,1-Dichloropropene	8260B	0.0050	6.7E-02	5.4E+02	NL	6.7E-02
1,2,3-Trichlorobenzene	8260B	0.0050	1.3E+01	4.6E+02	NL	1.3E+01
1,2,3-Trichloropropane	8260B	0.0050	2.7E-04	7.8E+00	NL	2.7E-04
1,2,4-Trimethylbenzene	8260B	0.0050	4.9E+00	3.7E+04	NL	4.9E+00
1,2-Dibromo-3-chloropropane	8260B	0.0050	8.7E-04	1.0E+01	NL	8.7E-04
1,2-Dichloroethane	8260B	0.0050	6.9E-03	6.0E+02	--	6.9E-03
1,2-Dichloropropane	8260B	0.0050	1.1E-02	8.0E+02	--	1.1E-02
1,3,5-Trimethylbenzene	8260B	0.0050	2.7E+01	3.7E+04	NL	2.7E+01
1,3-Dichloropropane	8260B	0.0050	3.2E-02	5.4E+02	NL	3.2E-02
1,4-Dichlorobenzene	8260B	0.0050	1.1E+00	2.3E+03	NL	1.1E+00
2,2-Dichloropropane	8260B	0.0050	6.0E-02	8.0E+02	NL	6.0E-02
2-Butanone	8260B	0.0050	1.5E+01	4.4E+05	NL	1.5E+01
2-Chlorotoluene	8260B	0.0050	4.5E+00	3.1E+03	NL	4.5E+00
2-Hexanone	8260B	0.0050	1.6E-01	4.4E+04	NL	1.6E-01
4-Chlorotoluene	8260B	0.0050	2.5E+00	1.5E+04	NL	2.5E+00
4-Isopropyltoluene	8260B	0.0050	NL	NL	NL	0.0E+00
4-Methyl-2-Pentanone	8260B	0.0050	2.5E+00	5.9E+04	NL	2.5E+00
Acetone	8260B	0.0050	2.1E+01	7.3E+04	NL	2.1E+01
Benzene	8260B	0.0050	1.3E-02	9.9E+02	--	1.3E-02
Bromobenzene	8260B	0.0050	1.2E+00	1.5E+04	NL	1.2E+00
Bromochloromethane	8260B	0.0050	1.5E+00	2.9E+04	NL	1.5E+00
Bromodichloromethane	8260B	0.0050	3.3E-02	8.8E+02	NL	3.3E-02
Bromoethane	8260B	0.0050	NL	NL	NL	0.0E+00
Bromoform	8260B	0.0050	3.2E-01	6.9E+03	--	3.2E-01
Bromomethane	8260B	0.0050	6.5E-02	1.0E+03	--	6.5E-02
Carbon Disulfide	8260B	0.0050	6.8E+00	7.3E+04	NL	6.8E+00
Carbon Tetrachloride	8260B	0.0050	3.1E-02	4.2E+02	--	3.1E-02
Chlorobenzene	8260B	0.0050	5.5E-01	1.5E+04	--	5.5E-01
Chloroethane	8260B	0.0050	1.5E+01	2.9E+05	--	1.5E+01
Chloroform	8260B	0.0050	5.1E-01	7.3E+03	--	5.1E-01
Chloromethane	8260B	0.0050	2.0E-01	4.2E+03	--	2.0E-01
cis-1,2-Dichloroethene	8260B	0.0050	1.2E-01	7.3E+03	NL	1.2E-01
cis-1,3-Dichloropropene	8260B	0.0050	3.3E-03	7.3E+01	--	3.3E-03
Dibromochloromethane	8260B	0.0050	2.5E-02	6.5E+02	--	2.5E-02
Dibromomethane	8260B	0.0050	5.6E-01	7.3E+03	NL	5.6E-01
Dichlorodifluoromethane	8260B	0.0050	1.2E+02	1.5E+05	NL	1.2E+02
Ethylbenzene	8260B	0.0050	3.8E+00	7.3E+04	--	3.8E+00
Ethylene Dibromide	8260B	0.0050	1.0E-04	6.4E-01	NL	1.0E-04

Table 1
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Isopropylbenzene	8260B	0.0050	1.7E+02	7.3E+04	NL	1.7E+02
m,p-Xylene	8260B	0.0050	5.3E+01	1.0E+06	--	5.3E+01
Methyl tert-Butyl Ether	8260B	0.0050	3.1E-01	7.3E+03	NL	3.1E-01
Methylene Chloride	8260B	0.0050	6.5E-03	7.3E+03	--	6.5E-03
Naphthalene	8260B	0.0050	1.6E+01	2.5E+03	NL	1.6E+01
n-Butylbenzene	8260B	0.0050	6.1E+01	6.1E+03	NL	6.1E+01
n-Propylbenzene	8260B	0.0050	2.2E+01	2.9E+04	NL	2.2E+01
o-Xylene	8260B	0.0050	3.5E+01	1.0E+06	--	3.5E+01
sec-Butylbenzene	8260B	0.0050	4.2E+01	2.9E+04	NL	4.2E+01
Styrene	8260B	0.0050	1.6E+00	1.5E+05	NL	1.6E+00
tert-Butylbenzene	8260B	0.0050	5.0E+01	2.9E+04	NL	5.0E+01
Tetrachloroethene	8260B	0.0050	2.5E-02	1.0E+03	--	2.5E-02
Toluene	8260B	0.0050	4.1E+00	1.5E+05	--	4.1E+00
trans-1,2-Dichloroethene	8260B	0.0050	2.5E-01	1.5E+04	--	2.5E-01
trans-1,3-Dichloropropene	8260B	0.0050	1.8E-02	5.4E+02	--	1.8E-02
Trichloroethene	8260B	0.0050	1.7E-02	4.4E+03	--	1.7E-02
Trichlorofluoromethane	8260B	0.0050	6.4E+01	2.2E+05	NL	6.4E+01
Vinyl Chloride	8260B	0.0050	1.1E-02	3.6E+01	--	1.1E-02
Organochlorine Pesticides						
DDD	8081A	0.0050	6.5E+00	1.2E+02	--	6.5E+00
DDE	8081A	0.0050	5.9E+00	8.7E+01	--	5.9E+00
DDT	8081A	0.0050	5.4E+00	8.7E+01	5.2E-02	5.2E-02
Aldrin	8081A	0.0050	5.0E-02	8.4E-01	--	5.0E-02
Dieldrin	8081A	0.0050	2.4E-02	8.9E-01	4.3E-03	4.3E-03
alpha-BHC	8081A	0.0050	4.0E-03	4.1E+00	--	4.0E-03
beta-BHC	8081A	0.0050	1.4E-02	1.4E+01	--	1.4E-02
delta-BHC	8081A	0.0050	8.7E-02	1.4E+01	--	8.7E-02
gamma-BHC (Lindane)	8081A	0.0050	4.6E-03	2.0E+01	9.9E-04	9.9E-04
alpha-Chlordane	8081A	0.0050	1.3E+01	4.1E+01	NL	1.3E+01
gamma-Chlordane	8081A	0.0050	7.3E+00	7.3E+01	NL	7.3E+00
alpha-Endosulfan	8081A	0.0050	2.3E+00	3.1E+02	--	2.3E+00
beta-Endosulfan	8081A	0.0050	2.3E+00	9.2E+02	--	2.3E+00
Endosulfan sulfate	8081A	0.0050	3.8E+02	9.2E+02	--	3.8E+02
Endrin	8081A	0.0050	3.8E-01	4.6E+01	--	3.8E-01
Endrin aldehyde	8081A	0.0050	1.9E+01	4.6E+01	NL	1.9E+01
Endrin ketone	8081A	0.0050	1.9E+01	4.6E+01	NL	1.9E+01
Heptachlor	8081A	0.0050	9.4E-02	3.2E+00	--	9.4E-02
Heptachlor epoxide	8081A	0.0050	2.9E-02	1.6E+00	--	2.9E-02
Methoxychlor	8081A	0.010	6.2E+01	7.7E+02	--	6.2E+01
Mirex	8081A	0.0050	1.3E+01	NL	--	1.3E+01
cis-Nonachlor	8081A	0.0050	5.6E+00	4.1E+01	NL	5.6E+00
Oxychlordane	8081A	0.0050	5.6E+00	4.1E+01	NL	5.6E+00
Toxaphene	8081A	0.20	1.2E+00	1.3E+01	--	1.2E+00
Trans-Nonachlor	8081A	0.0050	5.6E+00	4.1E+01	NL	5.6E+00
Chlorinated Herbicides						
2,4,5-T	8151	0.020	NL	NL	--	0.0E+00
2,4-D	8151	0.050	NL	2.5E+03	--	2.5E+03
2,4-D	8151	0.20	NL	2.5E+03	--	2.5E+03

Table 1
Armored Cap Material Analyte List

Parameter	Analytical Method	Reporting Limit (mg/kg)	TCEQ Tier I Residential Soil PCLs ⁽¹⁾ (mg/kg)	TRRP Tier 1 Sediment PCLs ⁽⁴⁾ (mg/kg)	TCEQ Marine PEL ⁽⁵⁾ (mg/kg)	Required Fill Chemical Concentration Criteria (mg/kg)
Dalapon	8151	0.050	2.9E-01	4.6E+03	NL	2.9E-01
Dicamba	8151	0.020	7.3E-01	4.6E+03	NL	7.3E-01
Dichlorprop	8151	0.050	2.3E-01	1.5E+03	NL	2.3E-01
Dinoseb	8151	0.020	1.8E-01	1.5E+02	NL	1.8E-01
MCPA	8151	10	1.2E-02	7.7E+01	NL	1.2E-02
MCPP	8151	10	2.3E-02	1.5E+02	NL	2.3E-02
Silvex	8151	0.020	2.6E+00	1.2E+03	NL	2.6E+00
Polychlorinated Biphenyls (PCBs)						
Total PCBs	8082	0.010	1.1E+00	2.3E+00	1.9E-01	1.9E-01
Dioxin/Furans, ng/kg						
Dioxins		ng/kg ⁽²⁾	ng/kg ⁽²⁾	ng/kg ⁽²⁾	ng/kg ⁽²⁾	ng/kg ⁽²⁾
2,3,7,8-TCDD	1613B	1.0	(3)	(3)	NL	(3)
1,2,3,7,8-PeCDD	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,4,7,8-HxCDD	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,6,7,8-HxCDD	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,7,8,9-HxCDD	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,4,6,7,8-HpCDD	1613B	5.0	(3)	(3)	NL	(3)
OCDD	1613B	10	(3)	(3)	NL	(3)
Furans						
2,3,7,8-TCDF	1613B	1.0	(3)	(3)	NL	(3)
1,2,3,7,8-PeCDF	1613B	5.0	(3)	(3)	NL	(3)
2,3,4,7,8,-PeCDF	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,4,7,8-HxCDF	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,6,7,8-HxCDF	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,7,8,9-HxCDF	1613B	5.0	(3)	(3)	NL	(3)
2,3,4,6,7,8-HxCDF	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,4,6,7,8-HpCDF	1613B	5.0	(3)	(3)	NL	(3)
1,2,3,4,7,8,9-HpCDF	1613B	5.0	(3)	(3)	NL	(3)
OCDF	1613B	10	(3)	(3)	NL	(3)

Notes:

1. TCEQ TRRP Tier I Residential Soil PCL Values, 30-acre source area, includes Total Soil Combined and GW Soil Ingestion (Class 1) exposure routes.
 2. Dioxin/furan concentrations expressed in ng/kg. All other concentrations in table expressed in mg/kg.
 3. Acceptable dioxin/furan concentration is less than 0.45 ng/kg of 2,3,7,8-TCDD and 5 ng/kg TEQ based on WHO 2005⁽⁶⁾ TEFs
 4. TCEQ TRRP Tier 1 Sediment PCL Values, includes ingestion and dermal pathways
 5. TCEQ Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, 2004
 6. Van den Berg et al. 2006. The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds. Toxicological Sciences 93(2): 223-241.
- NL - Not Listed
-- No value given

Table 2
Schedule of Values - Bid Table
Modified Alternative 3
San Jacinto TCRA

Item No.	Description	Quantity	Unit	Unit Price	Amount
Project Set Up					
1	Mobilization/Demobilization	1	LS	\$	\$
2	Health and Safety	1	LS	\$	\$
3	Quality Control	1	LS	\$	\$
4	Site Security	1	LS	\$	\$
5	Environmental Protection	1	LS	\$	\$
6	Survey Control	1	LS	\$	\$
7	Access Road Construction	1	LS	\$	\$
8	Big Star Property Improvements	1	LS	\$	\$
Cap Construction					
9	Clearing and Grubbing	1	LS	\$	\$
10	Surface Grading	1	LS	\$	\$
11	Geotextile	79,000	SQ YD	\$	\$
12	Armor Cap Material A	9,200	TONS	\$	\$
13	Armor Cap Material B	33,600	TONS	\$	\$
14	Armor Cap Material C	6,500	TONS	\$	\$
15	Armor Cap Material D	4,700	TONS	\$	\$
16	Armor Cap Material E	900	TONS	\$	\$
Direct Construction Costs Total					\$

ATTACHMENT A
STANDARD GENERAL CONDITIONS OF
THE CONSTRUCTION AGREEMENT

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION AGREEMENT

ARTICLE 1 - ASSIGNMENT

1.1 No assignment or delegation by a party hereto of any rights or duties under or interest in the Contract Documents will be binding on another party without the written consent of the party sought to be bound. In particular, CONTRACTOR may not assign its right to recover any moneys that may become due from CLIENTS without the consent of CLIENTS. Nothing in this Agreement shall limit the CLIENTS' right to freely assign or delegate any rights or obligations under this Agreement to any entity controlling, controlled by, or under common control with CLIENTS, or to the Environmental Protection Agency ("EPA").

1.2 CLIENTS and CONTRACTOR each binds itself, its respective affiliates, partners, successors, assigns, and legal representatives to the other parties hereto, their affiliates, partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

ARTICLE 2 - CHANGES

2.1 Work Directive Change.

CLIENTS may issue one or more Work Directive Changes ("WDC") in the form set forth in Exhibit C on or after the effective date of this Agreement, ordering an addition, deletion, or revision in the Scope of Services, or responding to differing or unforeseen physical conditions under which the Work is to be performed. A WDC will not change the Contract Price or Contract Time, but is evidence that CONTRACTOR and CLIENTS expect that the change directed or documented by a WDC will be incorporated in a subsequently issued Change Order (as described below) following negotiations by the CONTRACTOR and CLIENTS as to its effect, if any, on the Contract Price or Contract Time.

2.2 Change Order.

2.2.1 Contract Price and Contract Time may be adjusted only by written Change Order in the form set forth in Exhibit D. It is a condition precedent to any request by CONTRACTOR for an adjustment in Contract Price or Contract Time that CONTRACTOR deliver to CLIENTS written notice of the general nature of the claim and all facts or events giving rise to the claim, or any such claim shall be deemed waived.

2.2.2 This Agreement may be amended, altered, or changed only by a written Change Order signed by CLIENTS and CONTRACTOR; provided, however, that CLIENTS may reduce the Scope of Services herein without approval by CONTRACTOR.

2.2.3 CONTRACTOR shall give written notice to CLIENTS of any instructions, occurrences, or conditions which affect the Contract Price, Contract Time, or Scope of Work within ten (10) days of first obtaining knowledge thereof. The CLIENTS shall respond within ten (10) days to (a) deny the claim, (b) instruct CONTRACTOR to prepare a request for Change Order, either directly or by issuing a WDC, or (c) request additional information from CONTRACTOR.

2.2.4 Within ten (10) days of receipt of the instruction to prepare a request for Change Order, CONTRACTOR shall submit such written request to CLIENTS. Such request shall include a cover memorandum to CLIENTS identifying the change, supporting documentation and data (including a copy of any related WDCs authorized by CLIENTS and acknowledged by CONTRACTOR), and CONTRACTOR's written statement that the requested adjustment to the Contract Price and/or Contract Time covers all amounts to which CONTRACTOR is entitled as a result of the change. If the written request for a Change Order is not submitted within this ten (10) day period (or such further period allowed by the CLIENTS), CONTRACTOR shall be deemed to have abandoned its right to a Change Order and CLIENTS shall be released from any liability for costs arising from such proposed change. CLIENTS agree to respond within fifteen (15) days to any such properly submitted Change Order request and shall notify CONTRACTOR of its decision to authorize or reject the Change Order. CLIENTS' decision upon a request for a Change Order shall be final and shall bar any subsequent claim concerning the matters contained in the request unless CONTRACTOR, within ten (10) days of receipt of CLIENTS' decision, protests CLIENTS' decision in writing.

2.3 Allowances and Unit Prices.

2.3.1 If the Contract Price includes the items of Work priced at an allowance price per unit, activity, or division, or a unit price per item of Work, all such allowances or unit prices shall be set forth in the "Scope/Schedule/Price Form", Exhibit A. CONTRACTOR agrees that such allowances or unit prices include the cost to CONTRACTOR (less any applicable trade discounts) of all labor, materials, equipment, services, permits, taxes, all costs for unloading and handling on the Site, installation costs, overhead, profit, and other expenses, unless otherwise allowed or requested by CLIENTS.

2.3.2 Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due CONTRACTOR on account of Work covered by allowances or unit prices, and the Contract Price shall correspondingly be adjusted.

ARTICLE 3 - COMPLETION

3.1 Substantial Completion.

3.1.1 When CONTRACTOR considers the entire Work ready for its intended use (or a portion thereof as agreed by the parties), CONTRACTOR shall notify CLIENTS in writing that the Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) by submitting to CLIENTS a "Certificate of Substantial Completion", Exhibit J, for CLIENTS' approval. If, after receiving such notice, CLIENTS conclude that the Work or a portion thereof is not substantially complete, CLIENTS shall notify CONTRACTOR in writing within ten (10) days stating the reasons therefor. CLIENTS' decision shall be final and shall bar any subsequent claim concerning the date of Substantial Completion unless CONTRACTOR, within five (5) days of receipt of CLIENTS' decision, protests CLIENTS' decision in writing.

3.1.2 CONTRACTOR shall submit the following documents with its Certificate of Substantial Completion: maintenance and operating instructions, final schedules, guarantees, bonds, certificates of inspection, waivers and releases of lien, affidavit of wage rate compliance, marked-up and annotated record documents (including as-built drawings), and any other documents as required by the Contract Documents as a condition precedent to Substantial Completion.

3.1.3 CLIENTS shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but shall allow CONTRACTOR reasonable access to complete or correct items on the punch list.

3.2 Final Inspection.

3.2.1 Upon CONTRACTOR's submittal of a "Certificate of Final Completion", Exhibit J, notifying CLIENTS that the entire Work including punch list work is complete, CLIENTS will make a final inspection with CONTRACTOR, and CLIENTS will sign off on the Certificate if the Work is complete or will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to remedy any deficiencies.

3.2.2 CLIENTS' approval of the Certificate of Final Completion as set forth in Paragraph 3.2.1 above, and final payment as set forth in Paragraph 3.3 below, are subject to final approval of the Work by the EPA. CONTRACTOR shall fully cooperate with CLIENTS to generate or provide information for reports, inspections, and any other submissions required of CLIENTS by the EPA for the Project, and for any corrections and resubmissions of such documents and any correction of the Work as required by the EPA or other governmental authorities with jurisdiction.

3.3 Final Payment.

3.3.1 After CONTRACTOR has completed all Work and all corrections, CONTRACTOR may make its Application for Final Payment following the procedure for progress payments. The Application for Final Payment shall be accompanied by all documentation required by the Contract Documents, including a Final Receipt, Waiver, and Release of Lien Rights, Exhibit G, from CONTRACTOR and all Subcontractors and Vendors for all liens arising out of, or which may arise out of, or filed in connection with the Work. If any Subcontractor or Vendor fails to furnish a waiver/release of lien in full, CONTRACTOR shall furnish a bond or other collateral satisfactory to CLIENTS to indemnify CLIENTS against any lien or shall otherwise settle and remove such lien.

3.3.2 CONTRACTOR shall complete and submit with the Application for Final Payment a "Final Payment General Release and Indemnity Agreement", Exhibit H.

3.3.3 If CLIENTS are not satisfied that the Work has been completed in accordance with the Contract Documents, CLIENTS will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application. Within thirty-five (35) days after receipt by CLIENTS of the Application and accompanying documentation, in appropriate form and substance, and upon CLIENTS' determination that all of CONTRACTOR's other obligations under the Contract Documents have been fulfilled, the approved amount will be paid by CLIENTS to CONTRACTOR (subject to Paragraph 3.2.2 above).

3.4 CONTRACTOR's Warranty of Title.

CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by an Application for Payment, whether or not incorporated in the Work, will pass to CLIENTS no later than the time of final payment, free and clear of all liens.

3.5 Waiver of Claims.

CONTRACTOR's acceptance of final payment shall constitute a waiver of all claims by CONTRACTOR against CLIENTS except those previously made or reserved in writing at the time CONTRACTOR submits its Application for Final Payment.

ARTICLE 4 - CONFIDENTIALITY

4.1 CONTRACTOR agrees not to disclose to third parties any information provided to CONTRACTOR by CLIENTS (or CLIENTS' agents or contractors), or obtained by CONTRACTOR in the execution of the Work, which has not been previously disclosed to CONTRACTOR by outside third parties, or which is not in the public domain, without CLIENTS' prior written permission. CONTRACTOR shall further instruct its Subcontractors and Vendors to use their best efforts to safeguard any such information from unauthorized disclosure to third parties. Furthermore, CONTRACTOR will not disclose to its employees, agents, Subcontractors, or Vendors any such information if CONTRACTOR knows, or should reasonably know, that those persons may be involved in similar projects with direct competitors of CLIENTS.

4.2 To the extent confidential information is given to CONTRACTOR and is to be kept by CONTRACTOR as part of the record documents or other Project documents described in Article 8, CONTRACTOR shall hold such documents confidential.

ARTICLE 5 - CONTRACT DOCUMENTS

5.1 Intent.

5.1.1 The Contract Documents are complementary and are to be read as a whole; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the laws of the State of Texas.

5.1.2 It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any work, labor, materials, or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not they are specifically required. Reference to standard specifications, manuals, or codes of any technical society, organization, or association or to Applicable Laws, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or Applicable Laws in effect at the time of receipt of Bid(s), unless otherwise specifically stated. However, no provision of any standard specification, manual, or code shall be effective to change the duties and responsibilities of CLIENTS and CONTRACTOR or any of their employees, agents, consultants, or contractors from those set forth in the Contract Documents.

5.1.3 If, during the performance of the Work, CONTRACTOR finds a conflict, error, or discrepancy in the Contract Documents, CONTRACTOR shall so report to CLIENTS in writing at once, and before proceeding with the Work affected thereby, shall obtain a written interpretation or clarification from CLIENTS. CONTRACTOR shall be liable to CLIENTS for failure to report any conflict, error, or discrepancy in the Contract Documents if CONTRACTOR had actual knowledge or should reasonably have known thereof.

5.2 Amendment.

Except where specifically provided, the Contract Documents may be amended, altered, or changed only by written agreement, signed by both CLIENTS and CONTRACTOR.

ARTICLE 6 - DEFECTIVE WORK

6.1 Uncovering Work.

Any Work that is covered up shall, at CLIENTS' request, be uncovered by CONTRACTOR for inspection, testing, or observation. CONTRACTOR shall bear all direct, indirect, and consequential costs of such uncovering, inspection, or observation if the Work was covered without adequate notice to CLIENTS or is found to be defective in whole or in part.

6.2 Corrections or Removal.

During performance of the Work and for the one (1) year warranty period after the date of Final Completion, CONTRACTOR shall, as directed by CLIENTS, correct or remove and replace all defective Work, regardless of any prior inspection of the Work by CLIENTS, the EPA, or any other governmental authority with jurisdiction over the Work. CONTRACTOR shall bear all direct damages and loss arising from defects in the Work and correction or removal of such Work which later may be discovered. This obligation of CONTRACTOR to correct or remove and replace is intended to be an additional and not exclusive remedy of CLIENTS and shall not limit CLIENTS' exercise of any or all other rights or remedies provided by the Contract Documents or Applicable Laws, including but not limited to responsibility or liabilities of CONTRACTOR from latent defects, departures from the requirements of the Contract Documents, fraud or gross mistakes, or from damages resulting from any of the foregoing.

ARTICLE 7 - DELAY

7.1 For delays to the Work caused solely by the CLIENTS, CONTRACTOR's sole remedy against CLIENTS shall be an extension of time and the direct field costs incurred on account of such delay. Under no circumstances shall CONTRACTOR be entitled to any indirect field or home office costs, including home office overhead, or any costs which result from acceleration of the Work except as provided in Paragraph 18.1. For delays caused by an event beyond the control of CONTRACTOR or CLIENTS, CONTRACTOR's sole remedy for such delay shall be an extension of time, except where such delay could reasonably have been anticipated by CONTRACTOR.

7.2 For Delays within CONTRACTOR's control, caused by its negligence, or which reasonably could have been anticipated by CONTRACTOR, CONTRACTOR shall not be entitled to an extension of time and shall finish the work within the original Contract Time and Contract Price.

ARTICLE 8 - DOCUMENT OWNERSHIP

Neither CONTRACTOR nor any Subcontractor, Vendor, or other person or organization performing or furnishing any of the Work for CONTRACTOR shall have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other Project documents (or copies of any thereof) supplied, prepared by, or bearing the seal of CLIENTS or CLIENTS' Consultants; and they shall not reuse any of them on extensions of the Project or any other project without written consent of CLIENTS and specific written verification or adaptation by CLIENTS. All Contract Documents provided to CONTRACTOR by CLIENTS shall be returned to CLIENTS upon completion of the Work, except for one record set which CONTRACTOR may retain for record keeping purposes only.

ARTICLE 9 - HEALTH AND SAFETY

9.1 Safety and Protection.

9.1.1 CONTRACTOR shall designate a responsible representative at the Site whose duty shall be the prevention of accidents. This person shall be CONTRACTOR'S Resident Representative as set forth on the front page of the Agreement unless otherwise designated in writing by CONTRACTOR to CLIENTS.

9.1.2 CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to, all persons on the Site in connection with the Work, including CLIENTS' employees and representatives and third-party bystanders; all Work, materials, and equipment to be incorporated into the Site, whether stored on or off the Site; and all other property at the Site or adjacent thereto.

9.1.3 CONTRACTOR shall follow CLIENTS' safety rules, instructions, and policies in effect at the Site during CONTRACTOR's performance of the Work. CONTRACTOR shall specifically abide by the following: (a) Exhibit E – Safety Regulations for Outside Contractors, attached hereto, which shall be executed by CONTRACTOR prior to performance of any Work; (b) the Safety Bid Form, which may be provided separately, and shall be filled out by CONTRACTOR and made a part of the Contract Documents; and (c) the CLIENTS' Health and Safety Plan as required and approved by the EPA for this Project, which is incorporated herein.

9.1.4 When the use or storage of explosives, hazardous equipment, or Waste Material is necessary for the execution of the Work, CONTRACTOR shall give CLIENTS advance written notice of such use or storage, and shall exercise utmost care and carry on such activities under the supervision of properly qualified and licensed personnel in accordance with accepted standard procedures for handling these materials.

9.1.5 CONTRACTOR shall give all notices required by Applicable Laws related to the preservation of public health and safety and the prevention of accidents, and as otherwise required for the safe performance of the Work.

9.2 **Emergencies.**

9.2.1 In emergencies affecting the safety of persons or the Work or property at the Site or adjacent thereto, CONTRACTOR, without special instruction or authorization from CLIENTS, is obligated to act to prevent threatened damage, injury, or loss. CONTRACTOR shall give CLIENTS prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby.

9.2.2 In the event of any action or occurrence which causes or threatens the release of any Waste Material from the Site that constitutes an emergency situation or may present an immediate threat to public health or welfare or to the environment, CONTRACTOR shall immediately notify CLIENTS and the EPA's On-Scene Coordinator ("OSC") so that appropriate measures can be taken thereby.

9.3 **Employee Safety.**

9.3.1 CONTRACTOR will test its employees working on the Site for the presence of illegal drugs, alcohol, and unauthorized controlled substances, where not prohibited by Applicable Laws and otherwise in accordance therewith, under the following circumstances: (a) if there is reason to suspect the employee is working under the influence of illegal drugs, alcohol, or controlled substances; (b) if the employee is involved in an avoidable accident which results in injury to persons or which causes significant property damage; and (c) with respect to illegal drugs and controlled substances, on a random basis, using a nondiscriminatory selection procedure.

9.3.2 CONTRACTOR will not permit any of its employees to work on the Site who has had a positive test result under the circumstances described in Paragraph 9.3.1 or who refuses to undergo a test when asked to do so.

9.3.3 CONTRACTOR will require that its Subcontractors and Vendors which send employees on the Site agree to all of the provisions in this Paragraph 9.3.

ARTICLE 10 - INDEMNITY

10.1 CONTRACTOR COVENANTS AND WARRANTS THAT IT SHALL PROTECT, DEFEND, INDEMNIFY, AND HOLD HARMLESS CLIENTS, THE EPA, THE UNITED STATES OF AMERICA, AND THE RESPECTIVE CLIENTS' AFFILIATES, EMPLOYEES, AGENTS, OFFICERS, DIRECTORS, SHAREHOLDERS, AND LEGAL REPRESENTATIVES (COLLECTIVELY, "INDEMNITEES") FROM AND AGAINST ANY AND ALL CLAIMS, DEMANDS, LOSSES, DAMAGES, COSTS, FINES, PENALTIES, AND LIABILITIES, INCLUDING DEFENSE COSTS (COLLECTIVELY, "INDEMNITY CLAIMS"), RELATING IN ANY WAY TO OR ARISING OR ALLEGED TO ARISE BY REASON OF OR IN CONNECTION WITH CONTRACTOR'S OR ITS EMPLOYEES', AGENT'S, SUBCONTRACTORS', OR VENDORS' ACT OR OMISSION (WHETHER OR NOT NEGLIGENT) IN CONNECTION WITH THE PERFORMANCE OF THE WORK UNDER THIS AGREEMENT OR OCCURRING IN OR AROUND THE SITE (INCLUDING OTHER LANDS USED BY CONTRACTOR IN PERFORMING THE WORK), AND WHETHER BEFORE OR AFTER FINAL ACCEPTANCE OF THE WORK. THE FOREGOING OBLIGATIONS OF CONTRACTOR SHALL APPLY, WITHOUT LIMITATION, TO ANY FAILURE TO COMPLY WITH APPLICABLE LAWS, ANY CLAIM OF INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF CLIENTS, AND ANY FAILURE OF CONTRACTOR TO COMPLY WITH ANY PROVISION OF THIS AGREEMENT RELATING TO SAFETY OR WASTE MATERIALS.

10.2 THE INDEMNITY PROVISION PROVIDED HEREIN SHALL HAVE NO APPLICATION TO ANY INDEMNITY CLAIM WHICH RESULTS ONLY FROM THE SOLE NEGLIGENCE OF AN INDEMNITEE WITHOUT ANY FAULT OF THE CONTRACTOR OR ANY PERSON FOR WHOSE ACTS THE CONTRACTOR IS RESPONSIBLE. IT IS THE EXPRESSED INTENTION OF THE PARTIES THAT THE INDEMNITY PROVIDED HEREIN IS AN AGREEMENT BY CONTRACTOR TO INDEMNIFY AND PROTECT EACH INDEMNITEE FROM ITS OWN NEGLIGENCE EXCEPT TO THE EXTENT OF THE EXCLUSION IN THIS PARAGRAPH 10.2.

10.3 IF AND ONLY IF APPLICABLE LAWS PROHIBIT OR LIMIT AN INDEMNITEE'S RIGHT TO REQUIRE CONTRACTOR TO INDEMNIFY THE INDEMNITEE AGAINST ITS OWN FAULT, CONTRACTOR'S INDEMNIFICATION OBLIGATIONS SHALL BE REDUCED SO THAT CONTRACTOR AND THE INDEMNITEE SHALL EACH BEAR A SHARE OF ANY RESPONSIBILITY FOR SUCH CLAIM WHICH IS PROPORTIONATE TO THEIR RESPECTIVE FAULT OR AS OTHERWISE ALLOWED UNDER APPLICABLE LAWS.

10.4 THE INDEMNIFICATION OBLIGATIONS UNDER THIS ARTICLE 10 SHALL NOT BE LIMITED IN ANY WAY BY THE AMOUNT OR TYPE OF DAMAGES, COMPENSATION, OR BENEFITS PAYABLE UNDER WORKER'S OR WORKMEN'S COMPENSATION ACTS, DISABILITY BENEFIT ACTS, OR OTHER EMPLOYEE BENEFIT ACTS, AND SHALL SURVIVE FINAL COMPLETION AND ACCEPTANCE OF THE WORK AND THE TERMINATION OR COMPLETION OF THIS AGREEMENT.

ARTICLE 11 - INSPECTION

11.1 Inspections.

Before undertaking each part of the Work and as necessary throughout the performance of the Work, CONTRACTOR shall carefully review, inspect, and compare the Contract Documents, field conditions (including subsurface conditions, Underground Facilities, and existing structures), and the work of others. This review, inspection, and comparison are required in order to check and verify pertinent figures, measurements, and conditions necessary for proper execution and coordination of the CONTRACTOR's Work and with all other work of the Project. CONTRACTOR shall promptly report in writing to CLIENTS any conflict, error, or discrepancy, including any variance with Applicable Laws, which CONTRACTOR may discover at any time. Upon such discovery, CONTRACTOR shall obtain a written interpretation or clarification from CLIENTS before proceeding with any of the Work affected thereby. If CONTRACTOR proceeds with any of the Work affected by any discovered conflict, error, or discrepancy, CONTRACTOR shall be liable for all extra costs and delay incurred thereby.

11.2 Reports of Physical Conditions.

11.2.1 Explorations and Reports: Reference is made to the Special Conditions for identification of those reports, if any, of exploration and tests of subsurface conditions at the Site that have been utilized by CLIENTS in preparation of the Contract Documents. CONTRACTOR may reasonably rely upon the accuracy of the technical data contained in such reports, but not upon non-technical data, interpretations, or opinions contained therein or for the completeness thereof for CONTRACTOR'S purposes. Except as indicated herein and in Paragraph 11.2.6, CONTRACTOR shall have full responsibility with respect to subsurface conditions at the Site.

11.2.2 Existing Structures: Reference is made to the Contract Documents for identification of those drawings, if any, of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities referred to in Paragraph 11.3) which are at or contiguous to the Site that have been utilized by CLIENTS in preparation of the Contract Documents. CONTRACTOR may reasonably rely upon the accuracy of the technical data contained in such reports, but not upon non-technical data, interpretations, or opinions contained therein or for the completeness thereof for CONTRACTOR'S purposes. Except as indicated herein and in Paragraph 11.2.6, CONTRACTOR shall have full responsibility with respect to physical conditions in or relating to such structures.

11.2.3 Report of Differing Conditions: If CONTRACTOR believes that (a) any technical data on which CONTRACTOR is entitled to rely as provided in Paragraphs 11.2.1 and 11.2.2 is inaccurate, or (b) any physical condition uncovered or revealed at the Site differs materially from that indicated, reflected, or referred to in the Contract Documents, then the CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work in connection therewith, notify CLIENTS in writing about the inaccuracy or difference.

11.2.4 CLIENTS' Review: Upon notice by CONTRACTOR, CLIENTS will promptly review the pertinent conditions, determine the necessity of conducting additional explorations or tests with respect thereto, and advise CONTRACTOR in writing of CLIENTS' findings and conclusions.

11.2.5 Possible Document Change: If CLIENTS conclude that there is a material error in the Contract Documents or that, because of newly discovered conditions, a change in the Contract Documents is required, a WDC or a Change Order will be issued as provided in Article 2 to reflect and document the consequences of the inaccuracy or difference.

11.2.6 Possible Contract Price and Contract Time Adjustments: A necessary Contract Document change, an adjustment in the Contract Price, an adjustment of the Contract Time, or any combination thereof will be allowable to the extent that they are attributable to any such inaccuracy or difference as approved by CLIENTS.

11.3 **Reports of Underground Facilities.**

11.3.1 Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to CLIENTS by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Special Conditions: (a) CLIENTS shall not be responsible for the accuracy or completeness of any such information or data; and (b) the cost of all of the following will be included in the Contract Price and the CONTRACTOR shall have full responsibility for (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, (iv) the safety and protection thereof as provided in Paragraph 18.11.2, and (v) repairing any damage thereto resulting from the Work.

11.3.2 Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated in the Contract Documents and of which CONTRACTOR could not reasonably have been expected to be aware, CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work affected thereby (except in an emergency as permitted elsewhere herein), identify the owner (if any) of such Underground Facility and give written notice thereof to that owner and to the CLIENTS. CLIENTS will promptly review the Underground Facility to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the Underground Facility, the Contract Documents will be amended or supplemented to the extent necessary, and any necessary and appropriate changes will be made to the Contract Price and/or Contract Time. During such time for CLIENTS' review, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility. If the parties are unable to agree as to the amount of an appropriate change to the Contract Price and/or Contract Time, CONTRACTOR may make a claim therefor as provided in this Agreement.

ARTICLE 12 - INSURANCE

12.1 **General Insurance Requirements.**

12.1.1 With no intent to limit CONTRACTOR's liability under the indemnification provisions set forth in Article 10, CONTRACTOR covenants to provide and maintain in full force and effect during the term of this Agreement and all extensions and amendments thereto, at least the insurance and available limits of liability set forth in this Article 12 and in Exhibit I.

12.1.2 If any of the required insurance is written as "claims made" coverage and CLIENTS are required to be carried as an additional insured, then CONTRACTOR's insurance shall include a two-year extended discovery period after the last date that CONTRACTOR provides any Work under this Agreement.

12.1.3 "Aggregate" amounts of coverage for purposes of this Agreement are agreed to be the amounts of coverage available during a fixed 12-month policy period.

12.2 **Insurance to be Provided by CONTRACTOR.**

12.2.1 *Risks and Limits of Liability:* CONTRACTOR shall provide at a minimum the insurance coverages and limits of liability set forth on Exhibit I attached hereto, with appropriate notation and endorsements.

12.2.2 *Form of Policies:* The insurance may be in one or more policies of insurance, the form of which is subject to reasonable approval by CLIENTS. Each liability policy shall have a contractual liability endorsement or otherwise provide coverage for any liability assumed by CONTRACTOR under the indemnification or other provisions of this Agreement. It is agreed, however, that nothing CLIENTS do or fails to do with regard to the insurance policies shall constitute a waiver of CLIENTS' rights hereunder or relieve CONTRACTOR from its duties to provide the required coverage hereunder.

12.2.3 *Issuers of Policies:* The issuer of any policy must be acceptable to CLIENTS and have a certificate of authority to transact insurance business in the State of Texas. Each insurer must be responsible and reputable and must have financial capability consistent with the risks covered.

12.2.4 *Insured Parties:* Each policy, except those for Workers' Compensation and Professional Liability, must name CLIENTS, their respective affiliates, officers, agents, and employees, and the EPA as additional insured parties (collectively, the "Additional Insureds") on the original policy and all renewals or replacements during the term of this Agreement. CLIENTS' status as additional insured under the CONTRACTOR's insurance does not extend to instances of sole negligence of CLIENTS unmixed with any fault of the CONTRACTOR.

12.2.5 *Deductibles:* CONTRACTOR shall assume and bear any claims or losses to the extent of any deductible amounts and waives any claim it may ever have for the same against the Additional Insureds.

12.2.6 *Cancellation:* Each policy must expressly state that it may not be canceled or non-renewed unless thirty (30) days' advance notice is given in writing to CLIENTS by the insurance company.

12.2.7 *Subrogation:* Each policy must contain an endorsement to the effect that the issuer waives any claim or right to recover against the Additional Insureds, including but not limited to rights of subrogation as to all perils to the extent covered by insurance provided or any other property insurance applicable to the Work. CONTRACTOR shall require similar written waivers from each Subcontractor and Vendor in favor of the Additional Insureds.

12.2.8 *Endorsement of Primary Insurance:* Each policy must contain an endorsement that such policy is primary insurance to any other insurance available to the Additional Insureds with respect to claims arising hereunder.

12.2.9 *Liability for Premium:* CONTRACTOR shall be solely responsible for payment of all insurance premium requirements hereunder and CLIENTS shall not be obligated to pay any premiums.

12.2.10 CONTRACTOR shall be responsible for promptly reporting all claims to the appropriate insurer on behalf of itself, the CLIENTS, and all other Additional Insureds.

12.3 **Proof of Insurance.**

12.3.1 Prior to commencing the Work pursuant to this Agreement, CONTRACTOR shall furnish CLIENTS and the EPA with (a) Certificates of Insurance, (b) an affidavit from CONTRACTOR confirming that the Certificates accurately reflect the insurance coverage that will be available during the term of the Agreement, and (c) copies of all insurance policies. Failure of CONTRACTOR to provide such proof of insurance may be deemed, in CLIENTS' discretion, to constitute a breach of this Agreement.

12.3.2 Notwithstanding the proof of insurance requirements set forth above, it is the intention of the parties hereto that CONTRACTOR, continuously and without interruption, maintain in force the required insurance coverages set forth herein. Failure of CONTRACTOR to so comply shall constitute a default allowing CLIENTS, at their option, to immediately suspend or terminate Work under this Agreement. CLIENTS' review of or any acts or omissions related to insurance documents provided by CONTRACTOR, its agents, Subcontractors, or Vendors shall in no way constitute a waiver of CLIENTS' rights under this Agreement, including its right to terminate or suspend the Agreement.

ARTICLE 13 - LAWS

13.1 **Compliance.**

CONTRACTOR shall give all notices required by and comply with all Applicable Laws applicable at the time the Agreement is entered into for furnishing and performing the Work. Unless expressly required by Applicable Laws, CLIENTS shall not be responsible for monitoring CONTRACTOR's compliance with any Applicable Laws.

13.2 **Equal Employment Opportunity.**

By acceptance and execution of this Agreement, CONTRACTOR certifies its compliance with the Fair Labor Standards Act of 1938, as amended; paragraphs one (1) through seven (7) of Section 202 of Executive Order 11246, and all similar orders, rules, regulations, and laws prohibiting discrimination in employment, and further agrees that it will not discriminate on the basis of race, creed, color, sex, national origin, age, veteran, or handicapped status.

ARTICLE 14 - NOTIFICATION

Whenever any provision of the Contract Documents requires the giving of written notice or delivery of any item, it shall be deemed to have been validly delivered if given in person to the Authorized Representative of the party identified in the Agreement, or upon receipt by such Representative if sent by registered or certified mail (return receipt requested), postage prepaid, or overnight delivery service (with receipt) to the business address of such Representative identified in the Agreement.

ARTICLE 15 - OTHER WORK

15.1 Interface with Other Work.

CLIENTS or other contractors may perform work in or around the Site, and CONTRACTOR shall cooperate fully therewith. CONTRACTOR shall afford CLIENTS and other contractors proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and for the execution of such work. CONTRACTOR shall anticipate the above conditions and that the work of CLIENTS or other contractors may reasonably delay, disrupt, or interfere with the Work and the progress schedule and shall plan accordingly. CONTRACTOR shall be required to make its several parts of the Work come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work unless and until CONTRACTOR obtains the written consent of CLIENTS and others whose work will be affected.

15.2 CLIENT-Furnished Material and Equipment.

CLIENTS may furnish materials or equipment to the Site to be incorporated into the Work. If CLIENTS furnish any such equipment or materials, CONTRACTOR shall perform such tasks as are necessary to coordinate and install them to make the Work functionally complete. In connection with such equipment and materials, CONTRACTOR shall:

- * Familiarize itself with the related product data, samples, specifications, and drawings and notify CLIENTS of any discrepancies or problems anticipated in the use of such equipment and materials.
- * Designate the latest schedule delivery date for such items in the Construction Progress Schedule.
- * Handle such items at the Site in accordance with manufacturer's recommendations, including receiving and unloading, uncrating, and storage.
- * Promptly inspect such items jointly with CLIENTS, and record shortages and damaged or defective items.
- * Store and protect such items from exposure to elements and from other damage.
- * Repair and replace any items damaged by CONTRACTOR.
- * Install such items as indicated in the Contract Documents and in accordance with manufacturer's instructions.
- * Level and align CLIENT-furnished equipment. If applicable, furnish and install anchor bolts, anchor plates, washers, nuts, shims, and other necessary items as required for a complete installation.
- * Grout or otherwise finish adjacent areas as necessary.

ARTICLE 16 - PAYMENT AND RIGHT TO AUDIT

16.1 Schedule of Values.

The Schedule of Values established as provided in the Contract Document "Scope/Schedule/Price (SSP) Form", Exhibit A, will serve as the basis for progress payments and will be incorporated into a form as back-up to the "Application for Payment - Summary", Exhibit B (hereinafter, "Application for Payment") as acceptable to CLIENTS.

16.2 Progress Payments.

16.2.1 Following commencement of the Work, each Application for Payment shall cover a 30-day period. No later than the twenty-fifth (25th) day of a month, CONTRACTOR shall submit to CLIENTS an Application for Payment, filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as required herein and otherwise by the Contract Documents. The amount of retainage with respect to progress payments will be as stipulated in Paragraph 16.3.

16.2.2 With each Application for Payment, CONTRACTOR shall submit to CLIENTS the following documentation: (a) an itemization reflecting the Contractor's Schedule of Values, previous payments, and any retainage; (b) the "Sworn Statement on Subcontractors and Material Vendors", Exhibit E; (c) the "Partial Receipt, Waiver, and Release of

Lien Rights”, Exhibit G, for CONTRACTOR and for each Subcontractor and Vendor listed with respect for each such draw; (d) the Status Report as discussed in Paragraph 17.2; and (e) such other documents as may be reasonably requested by CLIENTS.

16.2.3 CLIENTS may refuse the whole or any part of any Application for Payment if: (a) the Work has not been performed, is defective, or completed Work has been damaged requiring correction or replacement; (b) there is reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Price or within the remaining Contract Time; (c) CLIENTS have corrected defective Work or completed Work; (d) the occurrence of any of the grounds for termination of the CONTRACTOR set forth in Article 24 has occurred; (e) third-party claims, including liens, have been filed or evidence exists indicating probable filing of such claims; (f) CONTRACTOR fails to make proper payments to Subcontractors or Vendors; (g) CONTRACTOR has persistently failed to carry out the Work in accordance with the Contract Documents or Applicable Laws; (h) CLIENTS are entitled to a set-off against the CONTRACTOR; or (i) the Application for Payment has not been properly submitted.

16.2.4 CLIENTS shall pay the approved net portion of each properly submitted Application for Payment within thirty (30) days after receipt.

16.2.5 Upon receipt of a progress payment from CLIENTS, the CONTRACTOR shall promptly pay its Subcontractors and Vendors their portion of such progress payment, and in no case later than seven (7) days.

16.3 **Retainage.**

During the performance of the Work, CLIENTS shall pay ninety percent (90%) of approved portions of each Application for Payment and withhold ten percent (10%) retainage. CONTRACTOR may make application for such retainage after certification of substantial completion of the Work as provided by the Contract Documents. Upon CLIENTS' receipt and approval of such application and all required lien waivers/releases from CONTRACTOR and its Subcontractors and Vendors, CLIENTS shall pay such retainage less an amount adequate to cover: (a) the costs of all defective, rejected, or incomplete Work; (b) all damages, losses, or expenses incurred by CLIENTS on account of defective, rejected, or incomplete Work or CONTRACTOR's performance of the Work; and (c) any claims or demands made, including liens filed or threatened to be filed by any person or entity against the CLIENTS or the Project Site, related to the CONTRACTOR's Work. The amount of retainage shall in no way limit CONTRACTOR'S liability under this Agreement.

16.4 **Retention of Project Documents; Right to Audit.**

CONTRACTOR agrees to keep accurate records showing all charges and expenses incurred by the CONTRACTOR for the Work, as well as all other documents related to the Project, for a period of ten (10) years after final completion of the Work. CLIENTS and the EPA have the right during such period, upon reasonable notice, to audit the direct costs, expenses, and disbursements made or incurred in connection with the Work to be performed and may examine any relevant records of the CONTRACTOR. No examination of the records shall unreasonably delay or defer the obligation of CLIENTS to make payment of undisputed invoices from the CONTRACTOR as provided herein, as long as such records are in order and accurately reflect the CONTRACTOR's actual costs incurred. Upon expiration of the required ten (10) year retention period, CONTRACTOR shall not destroy such records without prior written notice to and approval from CLIENTS.

ARTICLE 17 - REPORTING

17.1 **Progress Schedule.**

CONTRACTOR shall prepare and submit to CLIENTS, upon execution of this Agreement unless otherwise directed by CLIENTS, a preliminary Progress Schedule for the Work. This Progress Schedule shall include the dates for commencement of the Work, Substantial Completion, Final Completion, and other milestone stages of construction, if any, as set forth in Exhibit A. The CONTRACTOR shall, within ten (10) days after commencement of Work and with CLIENTS' input, make any appropriate revisions to finalize the Progress Schedule. Upon CLIENTS' approval, this Progress Schedule shall become the baseline for monitoring construction progress and become a Contract Document.

17.2 **Status Report.**

CONTRACTOR shall prepare a status report, which, unless otherwise required by CLIENTS, shall be submitted with the monthly Application for Payment. The status report shall include the following topics of information and data:

- * Major Work Tasks:
 - Accomplishments in previous period (Tasks started and completed)
 - Planned in next period (Tasks to start or be completed)
- * Problems: What assistance from CLIENTS may be required and actions being taken
- * Schedule:
 - Revised Progress Schedule
 - Status of milestone dates (critical path)
- * Cost: (by Schedule of Values tasks)
 - Quantities, if applicable, installed to-date, forecast to-go, and total
 - Committed and actual cost to-date, forecast to go and total for:
 - *equipment and material
 - *labor
 - *subcontracts

ARTICLE 18 - RESPONSIBILITIES OF CONTRACTOR

18.1 Acceleration of Work.

CLIENTS may direct CONTRACTOR to accelerate the Work. In the event such CLIENT-directed acceleration causes the CONTRACTOR to incur extra costs, CONTRACTOR expressly agrees that its sole and exclusive remedy for such acceleration shall be the additional labor, equipment, and material field costs, but not CONTRACTOR home office costs. Included in any Change Order documentation for additional acceleration costs, CONTRACTOR shall offset additional costs with reduced fixed labor, material, and equipment costs resulting from the shorter overall Project schedule. Nothing in this Paragraph shall imply that CLIENTS will be required to pay any additional cost unless such time is expended in response to a written directive from CLIENTS, which directive acknowledges that CLIENTS will pay such costs. CLIENTS expressly reserve the right to order CONTRACTOR to accelerate the Work in the event that CLIENTS determine, in their sole discretion, that CONTRACTOR will not meet the date specified in the Agreement for Substantial Completion. CLIENTS shall not be liable for any extra costs incurred by acceleration ordered because CONTRACTOR will not meet the date of Substantial Completion due to the CONTRACTOR'S fault.

18.2 Communication.

18.2.1 CONTRACTOR shall issue all communications to CLIENTS through the CLIENTS' Authorized Representative.

18.2.2 CONTRACTOR shall not publish or provide for publication any information (including photographs) associated with the Project without CLIENTS' prior written approval. This obligation continues for ten (10) years after termination or completion of this Agreement.

18.3 CONTRACTOR'S Continuing Obligation.

CONTRACTOR'S obligation to properly and timely perform and complete the Work in accordance with the Contract Documents and Applicable Laws shall be absolute. CONTRACTOR shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with CLIENTS. None of the following shall constitute an acceptance of Work not in accordance with the Contract Documents or a release of CONTRACTOR'S obligation to perform the Work in accordance therewith: recommendation or approval of any progress or final payment; the issuance of a Certificate of Substantial Completion; any use or occupancy of the Work or any part thereof by CLIENTS; any act of acceptance by CLIENTS or any failure to do so; any review and approval of a Shop Drawing or sample submission; observations, inspections, tests, or approvals by CLIENTS or others; or any correction of defective Work by CLIENTS.

18.4 Labor, Materials, and Equipment.

18.4.1 CONTRACTOR shall provide adequate numbers of competent, suitably qualified personnel to perform all aspects of the Work. CONTRACTOR shall, at all times, maintain good discipline and order at the Site. CONTRACTOR shall not be entitled to an extension of time due to the unavailability of labor.

18.4.2 CONTRACTOR shall comply with all Applicable Laws governing the employment of labor, including those relating to minimum wages, social security, and unemployment insurance. CONTRACTOR shall also employ such labor as appropriate or necessary given the prevailing labor practices and environment of the locality in which Work is to be executed, and given any applicable agreements which may exist between CONTRACTOR or CLIENTS and local and national labor unions.

18.4.3 Unless otherwise specified in the Contract Documents, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the furnishing, testing, start-up, and completion of the Work.

18.5 Land Survey.

As required by CLIENTS, CONTRACTOR shall employ a professional engineer or a registered land surveyor, licensed to perform survey work in the State of Texas, to lay out the Work in accordance with reference points established by CLIENTS in accordance with Paragraph 19.5. CONTRACTOR shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of CLIENTS.

18.6 Patent Fees and Royalties.

CONTRACTOR shall pay all license fees and royalties and shall indemnify and hold harmless CLIENTS and the other Indemnitees from and against all claims, damages, losses, and expenses (including attorneys' fees and court costs) arising out of any infringement or alleged infringement of patents or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

18.7 Permits.

CONTRACTOR shall obtain and pay for all construction permits and licenses, including any required occupancy or use permits, relating to the Work. CLIENTS will obtain all environmental and zoning permits required for the Work, and CONTRACTOR shall cooperate with CLIENTS in obtaining such permits. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of receipt of Bid(s). CONTRACTOR shall pay all charges of utility owners for connections to the Work, if any.

18.8 Record Documents.

CONTRACTOR shall maintain in a safe place at the Site one copy of all Contract Documents and any drawings, written interpretations, and clarifications, regardless of whether such drawings, interpretations, or clarifications are identified as Contract Documents in the Agreement. These documents, including a sepia or Mylar copy as applicable, shall be annotated to show all changes made during construction. These record documents will be made available to CLIENTS for reference during the course of the Work, and shall be delivered to CLIENTS upon completion of the Work.

18.9 Shop Drawings and Samples.

18.9.1 CONTRACTOR shall submit to CLIENTS for review and approval all Shop Drawings and samples in accordance with the schedule of Shop Drawing submissions (if any). These drawings and samples shall bear a written indication that CONTRACTOR has satisfied its responsibilities under the Contract Documents. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data.

18.9.2 At the time of each submission, CONTRACTOR shall give CLIENTS specific written notice of each substitution or variation between the Shop Drawing or sample and the requirements of the Contract Documents, and shall cause a specific notation thereof to be made on each Shop Drawing submitted to CLIENTS for review.

18.9.3 CLIENTS will review and approve, or will have reviewed and approved, Shop Drawings and samples with reasonable promptness. CLIENTS' review and approval shall not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto. The review and approval of any such items will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by CLIENTS, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval.

18.9.4 CLIENTS' review and approval of Shop Drawings or samples shall not relieve CONTRACTOR from responsibility for any substitution or variation from the requirements of the Contract Documents unless CONTRACTOR has notified CLIENTS in writing of each such substitution or variation at the time of submission as required by Paragraph 18.9.2, and CLIENTS have given written approval by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval. Further, any approval by CLIENTS will not relieve

CONTRACTOR from responsibility for errors or omissions in the Shop Drawings or from having to comply with the provisions of this Paragraph 18.9.

18.9.5 Where a Shop Drawing or sample is required by the Specifications, any related Work performed prior to CLIENTS' review and approval of the pertinent submission will be at the sole expense and responsibility of CONTRACTOR.

18.10 Substitutions or Variations.

18.10.1 There shall be no substitution or variation of materials or equipment specified or described in the Contract Documents without the prior written approval of the CLIENTS.

18.10.2 CLIENTS will be the sole judge of acceptability, and no substitution or variation will be ordered, installed, or utilized without CLIENTS' prior written acceptance, which will be evidenced by either a Change Order or an approved Shop Drawing in accordance with Paragraph 18.9.

18.11 Supervision.

18.11.1 CONTRACTOR shall supervise and direct the Work competently and efficiently, and as may otherwise be necessary to ensure that the Work is performed in accordance with the Contract Documents and Applicable Laws. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

18.11.2 CONTRACTOR shall designate an Authorized Representative and shall provide the presence of a Resident Representative at the Site at all times during progress of the Work. These representatives shall have authority to act on behalf of CONTRACTOR, and shall not be replaced without prior written consent of the CLIENTS. All communications given to the CONTRACTOR's Authorized Representative or the Resident Representative shall be binding on the CONTRACTOR.

18.11.3 CONTRACTOR shall be responsible for promptly removing and replacing non-performing CONTRACTOR personnel at the CLIENTS' request.

18.12 Use of Site.

18.12.1 CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Project Site and any additional lands that CONTRACTOR may have acquired access to for temporary construction facilities or storage of materials and equipment, and shall not unreasonably encumber such premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for, and shall indemnify and hold harmless the CLIENTS from any damage, including fees and charges of Consultants, attorneys, and other professionals and court costs, for trespass to any such premises, or to the CLIENTS or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the Work. CONTRACTOR shall at all times keep the CLIENTS' premises free and clear of all liens and encumbrances arising out of the Work.

18.12.2 CONTRACTOR shall comply with all the requirements of CLIENTS' and EPA's Site regulations and rules, which CONTRACTOR acknowledges may be amended by CLIENTS and/or the EPA from time to time.

18.12.3 During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste, rubbish, and other debris resulting from the Work. Upon completion of the Work, CONTRACTOR shall remove all waste, rubbish, and debris resulting from the Work from and about the premises, as well as all tools, appliances, construction equipment and machinery, and surplus materials, and shall leave the Site clean and ready for use by CLIENTS. CONTRACTOR shall restore to original condition all property not designated for alteration by the Contract Documents.

18.12.4 If the Contract Documents require disposal or shipment of Waste Material to off-Site waste management facilities, CONTRACTOR shall coordinate with CLIENTS for such disposal or shipment and shall otherwise abide by Applicable Laws and any special instructions by the EPA.

18.12.5 CONTRACTOR shall not load or permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any adjacent property to stresses or pressures that will endanger it.

18.13 Code of Conduct.

CONTRACTOR acknowledges that CLIENTS have a Code of Conduct for its contractors, a copy of which has been or will be provided to CONTRACTOR, and that, pursuant to the Code of Conduct and as further set forth therein, CONTRACTOR may not give anything more than nominal gifts to employees or customers of CLIENTS or their affiliates. In addition, the Code of Conduct requires all contractors to perform their work for CLIENTS ethically and lawfully, including prohibiting them from using information intentionally made not available to other participants in the bidding process for jobs or services with CLIENTS, even if such information is provided by an employee of CLIENTS or their affiliates. CONTRACTOR agrees to follow CLIENTS' Code of Conduct and, if requested, shall execute an acknowledgement (and cause its managerial employees involved in the Project to sign an acknowledgement) that it has read such Code of Conduct.

ARTICLE 19 - RESPONSIBILITIES OF CLIENTS

19.1 Acts or Omissions.

CLIENTS shall not be responsible for the acts or omissions of the CONTRACTOR or of any Subcontractor, Vendor, or any other person or organization performing or furnishing any of the Work for CONTRACTOR.

19.2 Communications.

CLIENTS shall issue all communications to CONTRACTOR through CONTRACTOR'S Authorized Representative or Resident Representative.

19.3 Defective Work Rejection and Testing.

CLIENTS may disapprove or reject Work which CLIENTS believe or determine to be defective. CLIENTS may require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

19.4 Land.

CLIENTS shall furnish the land upon which the Work is to be performed, rights-of-way for access thereto, and such other lands which are designated for the use of CONTRACTOR, but only as indicated in the Contract Documents. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by CLIENTS, unless otherwise provided in the Contract Documents.

19.5 Reference Points.

CLIENTS shall establish reference points for construction which in CLIENTS' judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall report to CLIENTS whenever any reference point is lost, destroyed, or requires relocation and, upon CLIENTS' prior written approval, shall be responsible for the accurate replacement or relocation of such reference point(s).

19.6 Site Visits.

CLIENTS and their representatives, the EPA, OSC, and other representatives and contractors of the EPA may make visits to the Site. CLIENTS will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work.

ARTICLE 20 - RIGHTS AND REMEDIES

Unless otherwise provided in the Contract Documents, the duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees, and obligations imposed upon CONTRACTOR by Articles 6, 9, 10, 13, 18, and 27 and Paragraph 3.4 are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed by or available under Applicable Laws, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Article will be as effective as if repeated specifically in all Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply. All representations, warranties, and guarantees made in the Contract Documents will survive termination or completion of the Agreement.

ARTICLE 21 - SEVERABILITY

The provisions of this Agreement and the Contract Documents shall be deemed severable, and the invalidity or unenforceability of any provision shall not affect the validity and enforceability of the other provisions thereof. If any

provision of this Agreement or other Contract Document is found unenforceable for any reason whatsoever, that provision shall be appropriately limited and given effect to the extent that it may be enforceable.

ARTICLE 22 - SUBCONTRACTORS AND VENDORS

22.1 A Subcontractor has a direct agreement with CONTRACTOR or with any other Subcontractor for the performance of a portion of the Work at the Site. A Vendor has a direct agreement with CONTRACTOR or with any Subcontractor for the furnishing of materials or equipment for the Work at the Site. At CLIENTS' request, CONTRACTOR shall provide CLIENTS with copies of any proposed agreement with a Subcontractor or Vendor, and shall make copies of such executed agreements available to CLIENTS. CONTRACTOR shall not be required to employ any Subcontractor, Vendor, or other person or organization against which CLIENTS may have any objection, or against which CONTRACTOR has reasonable objection.

22.2 All Work performed for CONTRACTOR by a Subcontractor or Vendor will be pursuant to an appropriate written agreement between CONTRACTOR and the Subcontractor or Vendor which specifically binds the Subcontractor or Vendor to the applicable terms and conditions of the Contract Documents for the benefit of CLIENTS. CONTRACTOR shall require all Subcontractors and Vendors to comply with all Applicable Laws relating to the Work. All Subcontractors and Vendors shall be responsible for their own safety program, and shall abide by the CLIENTS' Health and Safety Plan.

22.3 CLIENTS support the utilization and development of qualified Minority/Women-Owned Business Enterprises (M/WBE). CONTRACTOR agrees to make good faith efforts to place ten percent (10%) of the total dollar amount of CONTRACTOR's awarded contract-related purchases of services and materials with qualified M/WBEs. Minorities include, but are not limited to, Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Asian-Indian Americans, and Women. For the purposes of this Agreement, an M/WBE business is at least majority-owned by a minority or group of minorities and has its management and daily business controlled by one or more such individuals. At CLIENTS' request, CONTRACTOR shall submit to CLIENTS a minority subcontracting plan and/or report the dollar amounts paid by CONTRACTOR to M/WBE Subcontractors or Vendors for goods and services used in performance of the Work.

22.4 Nothing in the Contract Documents shall create any contractual relationship between CLIENTS and any Subcontractor, Vendor, or other person or organization that contracts with CONTRACTOR, nor shall it create any obligation on the part of the CLIENTS to pay or to see to the payment of any moneys due any such Subcontractor, Vendor, or other person or organization, except as may otherwise be required by Applicable Laws.

ARTICLE 23 - TAXES

CONTRACTOR shall pay all sales, consumer, use, and other similar taxes in accordance with the Applicable Laws of the place of the Project which are applicable to the performance of the Work.

ARTICLE 24 - TERMINATION AND STOPPAGE OF WORK

24.1 CLIENTS' Right to Stop the Work.

If the Work is defective, or if CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, CLIENTS may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated. This right of CLIENTS to stop the Work shall not give rise to any duty on the part of CLIENTS to exercise this right for the benefit of CONTRACTOR or any other party, nor shall it relieve the CONTRACTOR of its obligations under this Agreement.

24.2 Termination for Cause by CLIENTS.

24.2.1 Upon the occurrence of any one or more of the following events, CLIENTS may terminate the services of CONTRACTOR: (a) a petition in bankruptcy is filed by or against the CONTRACTOR or any equivalent or similar action under any Federal or state law relating to bankruptcy or insolvency; (b) CONTRACTOR makes a general assignment for the benefit of creditors, or a trustee, receiver, custodian, or agent of CONTRACTOR is appointed under Applicable Laws or contract for the purpose of enforcing a lien or for the benefit of CONTRACTOR's creditors; (c) CONTRACTOR becomes insolvent or admits in writing an inability to pay its debts generally as they become due; (d) CONTRACTOR materially violates any provision of the Contract Documents, or persistently fails to perform the Work in accordance with the Contract Documents; or (e) CONTRACTOR disregards Applicable Laws in performance of the Work.

24.2.2 CLIENTS may terminate the services of CONTRACTOR under Paragraph 24.2.1 after giving CONTRACTOR seven (7) days' written notice. Upon Notice of Termination, CLIENTS may exclude CONTRACTOR from the Site and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the Site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate into the Work all materials and equipment stored at the Site or for which CLIENTS have paid CONTRACTOR but which are stored elsewhere, and finish the Work as CLIENTS may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the CLIENTS' direct, indirect, and consequential costs of completing the Work (including but not limited to fees and charges of Consultants, attorneys, and other professionals and court costs), such excess will be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to CLIENTS. Such costs incurred by CLIENTS will be incorporated into a Change Order. The exercise of any right or remedy under this Paragraph by CLIENTS shall not foreclose CLIENTS from the exercise of any other legal or equitable remedy, and the CLIENTS shall not be required to obtain the lowest price for the Work performed.

24.2.3 After receiving CLIENTS' written notice under Paragraph 24.2.2, CONTRACTOR shall, as requested by CLIENTS, assign subcontracts and purchase orders to CLIENTS or otherwise terminate subcontracts and purchase orders, and enter into no further subcontracts and purchase orders.

24.2.4 A termination for cause by CLIENTS hereunder will not affect any rights and remedies of CLIENTS against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by CLIENTS will not release CONTRACTOR from liability.

24.3 Termination or Suspension for Convenience by CLIENTS.

24.3.1 Upon seven (7) days' written notice to CONTRACTOR, CLIENTS may at any time, without cause and for CLIENTS' convenience and without prejudice to any other right or remedy, elect to terminate the Agreement, and may abandon the Work, in whole or in part. After receipt of a notice of termination under this Paragraph and except as otherwise directed by CLIENTS, CONTRACTOR shall: (a) stop Work under the Agreement; (b) terminate all purchase orders, subcontracts, and rental agreements to the extent that they relate to the performance of Work terminated; (c) settle all outstanding liabilities and all claims arising out of termination of purchase orders and subcontracts; (d) assign to CLIENTS, as directed by CLIENTS, all of the CONTRACTOR'S rights, title, and interest under purchase orders and subcontracts for the Work; (e) transfer title and deliver to CLIENTS, as directed by CLIENTS, the fabricated or unfabricated parts of the Work in progress, completed Work, supplies, and other materials produced as a part of, or acquired in connection with, the performance of the Work, and the completed or partially completed plans, drawings, information, and other property which, if the Agreement had been completed, would have been required to be furnished to CLIENTS; and (f) take such action as may be necessary, or as CLIENTS may direct, for the protection and preservation of the property related to this Agreement which is the possession of CONTRACTOR.

24.3.2 In the event of termination under Paragraph 24.3.1, CONTRACTOR shall submit to CLIENTS, within thirty (30) days of the receipt of the written notice of termination, its itemized costs for unpaid Work as of the termination date, together with all costs of Work in process and materials and equipment rented or ordered prior to the notice of termination and which were not terminable as required by CLIENTS. CLIENTS shall, within thirty-five (35) days following receipt of such itemized costs, pay CONTRACTOR for such costs, together with an appropriate pro-rata portion of CONTRACTOR's profit and overhead thereon, which shall not exceed fifteen percent (15%) of all field costs incurred by CONTRACTOR. Under no circumstances shall the costs used to calculate the pro-rata portion of CONTRACTOR's profit and overhead include any home office overhead or administrative costs, or any other damages related to such termination.

24.3.3 Further, the CLIENTS may, for their convenience and without cause, order the CONTRACTOR in writing to suspend, delay, or interrupt the Work in whole or in part for such period of time as the CLIENTS may determine. The Contract Price and Contract Time shall be adjusted for increases in the actual cost and time caused by suspension, delay, or interruption as allowed under this Agreement. No adjustment shall be made to the extent that (a) performance is, was, or would have been so suspended, delayed, or interrupted by another cause for which the CONTRACTOR is responsible; or (b) an equitable adjustment is made or denied under another provision of the Agreement.

24.4 Termination by CONTRACTOR.

If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety (90) days, or CLIENTS fail to act on any Application for Payment within ninety (90) days after it is submitted, or CLIENTS fail for sixty (60) days beyond the payment due date to pay CONTRACTOR any approved portion of an Application for Payment, then CONTRACTOR may, upon ten (10) days' written notice to CLIENTS, and upon CLIENTS' failure to cure, terminate the

Agreement and recover from CLIENTS payment for all Work executed plus reasonable profit and overhead thereon. CONTRACTOR shall not be entitled to payment for Work not executed, or profit and overhead thereon, or for any other termination damages.

ARTICLE 25 - TESTS AND INSPECTIONS

25.1 CLIENTS and their representatives, testing agencies, the EPA, OSC, and any other EPA representatives or contractors, and other governmental agencies with jurisdiction shall have access to the Work at all reasonable times for observation, inspecting, and testing of the Work. CONTRACTOR shall provide proper and safe conditions for such access.

25.2 CONTRACTOR shall give CLIENTS timely notice of readiness of the Work for all required inspections, tests, or approvals. All inspections, tests, or approvals shall be performed by organizations acceptable to CLIENTS and CONTRACTOR, or as required by the EPA.

25.3 If Applicable Laws require any Work, or part thereof, to be inspected, tested, or approved, CONTRACTOR shall assume full responsibility therefor, pay all costs in connection therewith, and furnish CLIENTS with the required certificates of inspection, testing, or approval. CONTRACTOR shall be responsible for and shall pay all costs in connection with any inspection or testing required in connection with CLIENTS' consideration of the CONTRACTOR'S materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval.

ARTICLE 26 - WAIVER

No act or failure to act to exercise the rights enjoyed by CLIENTS to demand the obligations owed to CLIENTS by CONTRACTOR shall constitute a waiver of any right enjoyed or obligation owned.

ARTICLE 27 - WARRANTY AND GUARANTEE

27.1 CONTRACTOR warrants and guarantees to CLIENTS that all Work shall be of high quality that will meet or exceed all specification and performance standard requirements. The Work shall be new (except as provided in the Contract Documents), installed in accordance with the Contract Documents, and shall be free from defects in material and workmanship for one (1) year after Final Completion.

27.2 Upon final payment, CONTRACTOR, unless otherwise directed by CLIENTS, shall assign to CLIENTS all warranties and guarantees to be provided by vendors, but shall remain responsible to CLIENTS for any repair or replacement required to the Work during the CONTRACTOR's warranty period.

ARTICLE 28 - CLAIMS AND DISPUTE RESOLUTION

28.1 Claims.

28.1.1 Claims, disputes, or other matters in controversy arising out of or related to the Agreement ("Claims"), except those waived as specifically provided for in the Contract Documents, shall be subject to an initial review process and mediation as conditions precedent to binding dispute resolution.

28.1.2 In the event of a Claim against the CONTRACTOR, the CLIENTS may, but are not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to the possibility of a CONTRACTOR's default, the CLIENTS may, but are not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

28.2 Initial Review and Informal Attempts to Resolve.

28.2.1 Any Claim shall first be submitted in writing to Project Coordinator. The party making the Claim shall provide a memorandum of such Claim to the Project Coordinator, clearly stating the disputed issue and including or incorporating by specific reference all information and documents that the claimant wants the Project Coordinator to consider. Within fourteen (14) days of receipt of a written Claim, Project Coordinator shall issue its opinion for resolving such Claim.

28.2.2 If the parties cannot reach a mutually satisfactory resolution of a Claim pursuant to the Project Coordinator's recommendation, and any informal negotiations by the parties related thereto, the parties shall proceed with formal, non-binding mediation as set forth in Paragraph 28.3.

28.3 Mediation.

28.3.1 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of execution of this Agreement. The parties may agree to private mediation with a mediator of their mutual choosing. A request for mediation shall be made in writing, delivered to the other party to the Agreement, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of sixty (60) days from the date of filing, unless stayed for a longer period by agreement of the parties or court order.

28.3.2 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in Houston, Texas, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

28.4 If requested, CONTRACTOR agrees to cooperate with CLIENTS in any dispute resolution proceedings between CLIENTS and the EPA to the extent related to the Work under the Agreement.

ARTICLE 29 - GLOSSARY

Wherever used in these Standard General Conditions or in the Contract or Bidding Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

Addenda: Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Documents.

Agreement: The written contract between CLIENTS and CONTRACTOR covering the Work to be performed including other Contract Documents attached to the Agreement and made a part thereof as provided therein.

Applicable Laws: All laws, rules, regulations, ordinances, codes, and/or orders of any federal, state, or local governmental entity having jurisdiction over and applicable to the Work and the parties, including but not limited to regulations of the Environmental Protection Agency (EPA), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. § 9601 *et seq.*, the Solid Waste Disposal Act, as amended, 42 U.S.C. § 6901 *et seq.* (a.k.a., Resource Conservation and Recovery Act (RCRA)), and the Occupational Safety and Health Administration (OSHA).

Application for Payment – Summary: The form specified as Exhibit B, to be completed by the CONTRACTOR, to request progress or final payments and which is to have attached such supporting documentation as is required by the Contract Documents. (See Exhibit B to the Agreement.)

Authorized Agent: The individual designated by an organization that is a party to the Agreement (*e.g.*, CLIENTS, CONTRACTOR, Vendor, etc.) who has been authorized to bind the organization to the Agreement.

Authorized Representative: The individual designated by an organization who will receive official notices on behalf of the organization, and who can solely bind the organization within prescribed limits.

Bid: The offer or proposal of the Bidder submitted on the prescribed form ("Scope/Schedule/Price Form" – Exhibit A) setting forth the prices and schedule for the Work to be performed.

Bidder: One who submits a Bid directly to CLIENTS, as distinct from a sub-bidder, who submits a bid to Bidder.

Bidding Documents: Includes the Invitation to Bid, Instructions to Bidders, and the "Contract Documents" (including all Addenda issued prior to receipt of Bids by CLIENTS).

Bonds: Bid, performance and payment bonds, and other instruments of security for performance of CONTRACTOR's obligations under the Contract Documents.

Change Order: A document, which is signed by CONTRACTOR and CLIENTS, authorizing an addition, deletion, or revision in the Work, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement (See Exhibit D).

CLIENTS: CLIENTS shall refer to International Paper Company, Inc. and McGinnes Industrial Maintenance Corporation.

Consultant: The provider of technical design or study services.

CONTRACTOR: The person, firm, or corporation with whom CLIENTS have entered into this Agreement. (Designated as “Supplier” or “Contractor” of Construction Services on all Exhibits – see Supplier.)

Contract Documents: The documents so identified in the Agreement which, taken together, comprise the entire Agreement between the parties relating to the Work.

Contract Price: The moneys payable by CLIENTS to CONTRACTOR under the Agreement as stated in the Contract Documents, specifically on “Scope/Schedule/Price Form” – Exhibit A.

Contract Time: The number of days or the date stated in the Agreement and specifically on “Scope/Schedule/Price Form” – Exhibit A, for completion of the Work.

Days: Working days as defined by CLIENTS’ Authorized Representative (not calendar days).

Defective: An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient; does not conform to the Contract Documents; does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents; or has been damaged prior to CLIENTS’ approval of final payment.

Direct Cost for Delay (Field or Home Office): Costs incurred by a CONTRACTOR in Article 7 that would have not have been incurred but for the delay. Direct costs may include some of the following: rental equipment, CONTRACTOR jobsite staff, CONTRACTOR labor that is maintained during the delay, and other supportable costs resulting from the delay. (Note: Direct Cost in this definition does not follow the construction industry definition.)

Drawings: The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by CLIENTS and are referred to in the Contract Documents.

Effective Date of the Agreement: The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the CLIENTS.

EPA: The United States Environmental Protection Agency and any successor departments or agencies of the United States.

Indirect Cost for Delay (Field or Home Office): Costs which are not directly supportable to a delay event as described in Article 7 such as loss of labor productivity due to the interruption, or CONTRACTOR opportunity cost to use labor, and equipment for other purposes. (Note: Indirect Cost in this definition does not follow the construction industry definition.)

Notice of Award: The written notice by CLIENTS to the apparent successful Bidder stating that upon compliance by the apparent successful Bidder with the conditions precedent enumerated therein, within the time specified, CLIENTS will sign and deliver the Agreement.

Notice to Proceed: A written notice given by CLIENTS to CONTRACTOR fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR’s obligations under the Contract Documents.

On-Scene Coordinator: The individual designated by the EPA as its On-Scene Coordinator (“OSC”) for the Project.

“Or Equal”: When used in any Contract Document, it will mean “or CLIENT-approved equal.”

Partial Completion: Placing a portion of the constructed Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all of the Work.

Project: The total construction of which the Work to be provided under the Contract Documents may be the whole or a part, as indicated elsewhere in the Contract Documents.

Project Coordinator: CLIENTS’ representative located at the Project Site who has administrative contract oversight representing the CLIENTS’ interests as approved by the EPA.

Provide or Provided: Means “furnish and install”.

Resident Representative – CONTRACTOR: CONTRACTOR's representative, located at the Project Site during the progress of the Work, who has contractual administrative responsibility on behalf of the CONTRACTOR.

Schedule of Values: CONTRACTOR's itemized listing of activities of the Work, setting forth in a form acceptable to CLIENTS the CONTRACTOR's allocation of the Contract Price by task. These same tasks shall be incorporated into CONTRACTOR's Progress Schedule and Applications for Payment.

Shop Drawings: All drawings, diagrams, illustrations, schedules, and other data requested by CLIENTS which are specifically prepared by or through CONTRACTOR to illustrate some portion of the Work; and all illustrations, brochures, standard schedules, calculations, drawings, performance charts, instructions, diagrams, and other information prepared by a Vendor and submitted by CONTRACTOR as requested by CLIENTS to illustrate material or equipment for some portion of the Work.

Site: The Project Site is the San Jacinto River Waste Pits Superfund Site located in Pasadena, Harris County, Texas, encompassing an approximately 20.6-acre tract of land bounded on the south by Interstate Highway 10, on the east by the San Jacinto River main channel, and on the north and west by shallow water off the River's main channel, as further described and depicted in the Contract Documents.

Specifications: Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

Subcontractor: An individual, firm, or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

Substantial Completion: The Work (or a specified part thereof) has progressed to the point where, in the opinion of CLIENTS as evidenced by CLIENTS' acceptance of a definitive Certificate of Substantial Completion – Exhibit J, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part thereof) can be utilized for the purposes for which it is intended and incorporates all equipment supplied by the CLIENTS, ready for operation; or if there be no such certificate issued, when final payment is due in accordance with Paragraph 3.3. The terms "substantially complete" and "substantially completed" as applied to any Work refer to Substantial Completion thereof. (See Exhibit J.)

Successful Bidder: The Bidder to whom CLIENTS (on the basis of CLIENTS' evaluation) makes an award.

Special Conditions: The part of the Contract Documents which amends or supplements the Agreement with site-specific or individual project-specific data or contract language. Site-specific language may include health and safety regulations, security requirements, or other requirements related to the CLIENTS' ongoing operations. Project-specific language may include revisions to the Agreement or General Conditions language.

State: Any references in the Contract Documents to the "state" shall mean the State of Texas.

Supplier: Any Consultant, Contractor, or Vendor that is a supplier of services, goods, and/or equipment to CLIENTS.

Underground Facilities: All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasement containing such facilities, which have been installed underground to furnish any services or materials, including but not limited to: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems, or water.

Unit Price Work: Work to be paid for on the basis of unit prices as shown on CONTRACTOR'S Schedule of Values.

Unit Price: The price of a unit of Work as shown in CONTRACTOR's Schedule of Values.

Unit Price – Alternate: The alternate price, as shown as an alternate on the Schedule of Values, of a unit of Work for deviations of more than a fixed percentage from the Unit Price as shown in the Schedule of Values.

Vendor: An individual or organization in the business of manufacturing, fabricating, distributing or providing material, goods, or equipment.

Waste Material: Any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); and any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27).

Work: The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor, and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

Work Directive Change: A written directive to CONTRACTOR, issued on or after the effective date of the Agreement and signed by CLIENTS, ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed. (See Exhibit C.)

(END OF STANDARD GENERAL CONDITIONS)

ATTACHMENT B

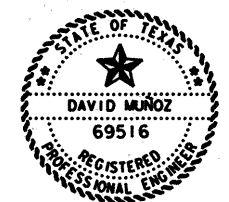
REFERENCE DRAWINGS

2. EXISTING
SERVICE POLE
3. EXISTING
1-2" CONDUIT
2#6#XHHW, 1#6 BARE (CCTV POWER)

SEE SHEET 5 OF 12
FOR LEGEND

FILE NAME: 1H-10-292-06.DGN

MATCHLINE @ 14+10 (EAST FREEWAY)
STA. 807+00 SEE SHEET 7 OF 12



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David Muñoz
P.E. 69516, on

8-3 . 2007
David M. Mung, P.E.



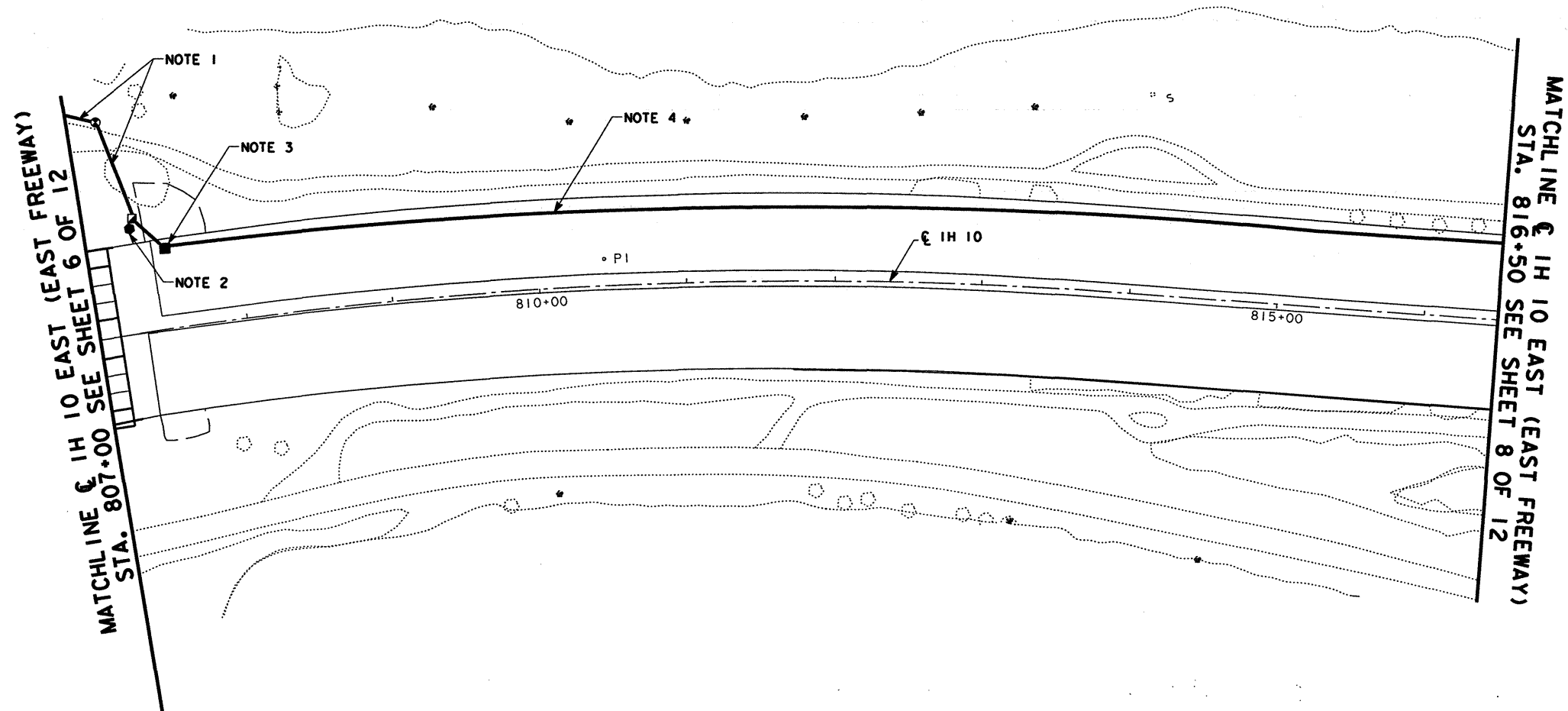
TEXAS DEPARTMENT OF TRANSPORTATION
IH 10 (EAST FREEWAY)

COMPUTERIZED TRANSPORTATION MANAGEMENT SYSTEM LAYOUT

SHEET 6 OF 12

SHEET 6 OF 12															
DN# RFB		DRAWING		DATE		FED. RD. DIV. RD.		STATE		PROJECT NO.				HIGHWAY NO.	
CK DN# KPB		ORIGINAL		MAY 07				6 TEXAS						IH 10	
DN# CC								STATE		COUNTY				CONTROL NO. SECTION NO. JOB NO. SHEET NO.	
CK DN# SCF								6		HOUSTON				0508 01 292 487	
TR#															
CK TR#															

1. **EXISTING**
1-2" CONDUIT
2#6XHHW, 1#6 BARE (CCTV POWER)
2. **EXISTING**
CCTV CAMERA
CAMERA SUPPORT POLE & FOUNDATION
CCTV CABINET
CCTV FIELD EQUIPMENT
1 STAND ALONE LDM
VIDEO FIBER OPTIC TX (M/M)
3-2" CONDUITS TO GRD. BOX
IN COND. #1 - 1-6 PAIR #22 COMM. CABLE (CCTV)
IN COND. #2 - 2#6XHHW, 1#6 BARE (CCTV POWER)
IN COND. #3 - FIBER DROP CABLE



3. **EXISTING**
JUNCTION BOX
4-3" RMC TO GRD. BOX
IN COND. #1 - 1 SINGLE MODE FIBER OPTIC CABLE
1 MULTIMODE FIBER OPTIC CABLE
FIBER DROP CABLE
1-6 PAIR #22 COMM. CABLE (VOICE COMM.)
IN COND. #2 - 1-6 PAIR #22 COMM. CABLE (CCTV)
4. **EXISTING**
4-3" RMC (SUSPENDED BENEATH BRIDGE)
IN COND. #1 - 1 SINGLE MODE FIBER OPTIC CABLE
1 MULTIMODE FIBER OPTIC CABLE
FIBER DROP CABLE
1-6 PAIR #22 COMM. CABLE (VOICE COMM.)
IN COND. #2 - 1-6 PAIR #22 COMM. CABLE (CCTV)

NO CTMS WORK ON THIS SHEET
FOR INFORMATION ONLY

SEE SHEET 5 OF 12
FOR LEGEND

SCALE: 1" = 100'

FILE NAME: IH-10-292-07.DGN



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2007
B-3
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TEXAS DEPARTMENT OF TRANSPORTATION
IH 10 (EAST FREEWAY)

**COMPUTERIZED TRANSPORTATION
MANAGEMENT SYSTEM LAYOUT**

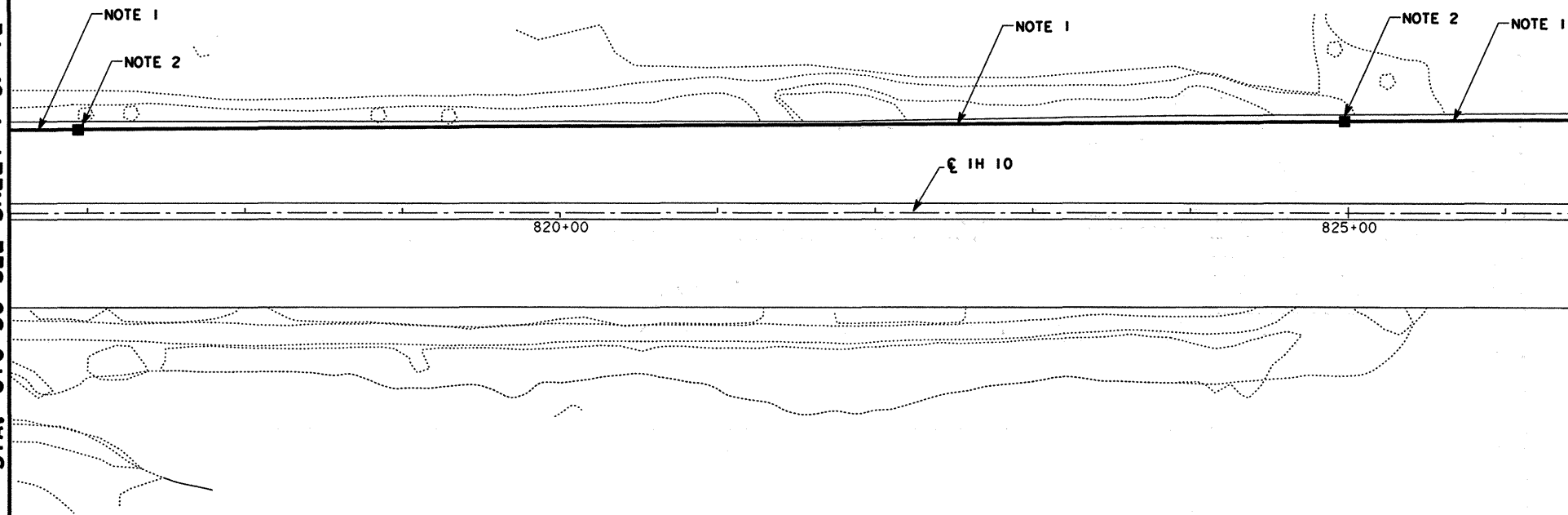
SHEET 7 OF 12

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CK	DN#	SC					
TR#							
CK	TR#						

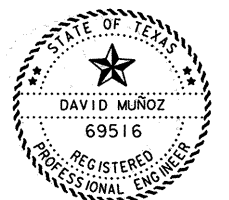
NAME/ENTER DATA

1. EXISTING
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IN COND. #1 - 1 SINGLE MODE FIBER OPTIC CABLE
1 MULTIMODE FIBER OPTIC CABLE
FIBER DROP CABLE
1-6 PAIR #22 COMM. CABLE (VOICE COMM.)
IN COND. #2 - 1-6 PAIR #22 COMM. CABLE (CCTV)
2. EXISTING
JUNCTION BOX

MATCHLINE @ IH 10 EAST (EAST FREEWAY)
STA. 816+50 SEE SHEET 7 OF 12



MATCHLINE @ IH 10 EAST (EAST FREEWAY)
STA. 826+50 SEE SHEET 9 OF 12



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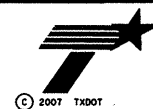
8-3
David Muñoz, P.E.

NO CTMS WORK ON THIS SHEET
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SEE SHEET 5 OF 12
FOR LEGEND

SCALE: 1" = 100'

FILE NAME: IH-10-292-08.DGN



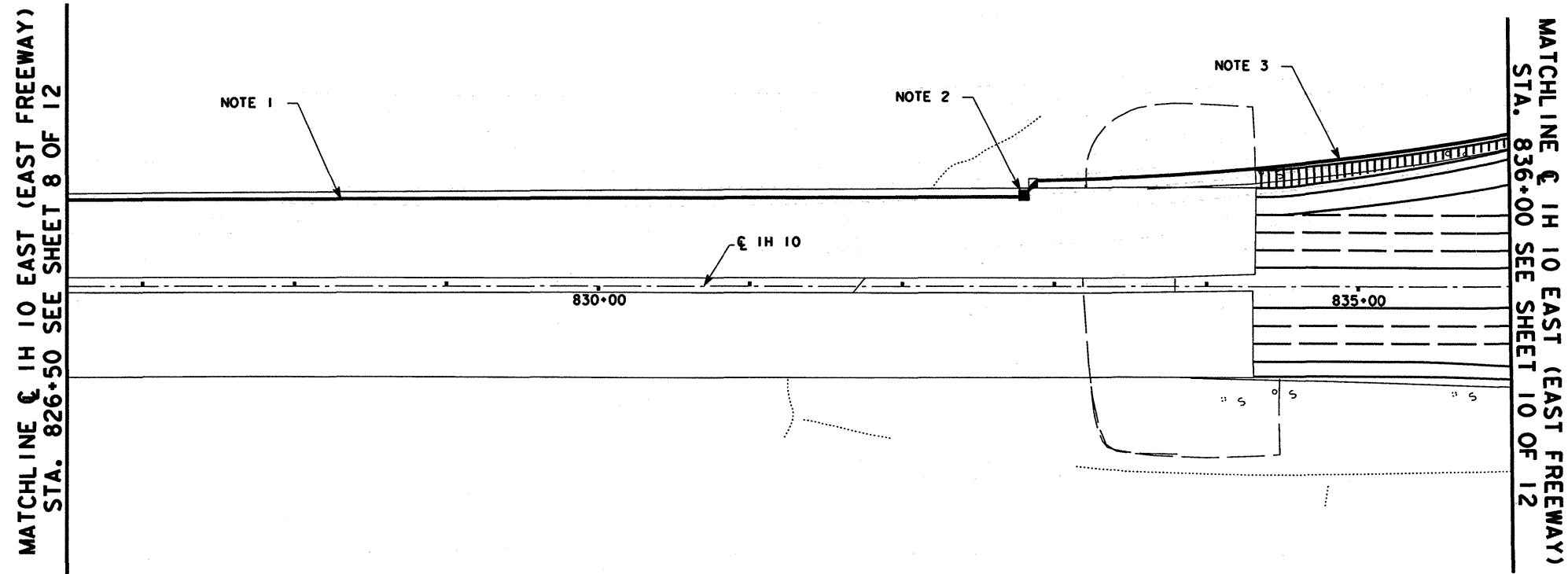
TEXAS DEPARTMENT OF TRANSPORTATION
IH 10 (EAST FREEWAY)

COMPUTERIZED TRANSPORTATION
MANAGEMENT SYSTEM LAYOUT

SHEET 8 OF 12

DN#	RFB	DRAWING	DATE	FED. RD. DIST. NO.	STATE	PROJECT NO.	HIGHWAY NO.
CK DN#	KPB	ORIGINAL	MAY 07	6	TEXAS		IH 10
DW#	CCF						
CK DW#	SC						
TR#							
CK TR#							
		STATE DIST. NO.	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
		HOUSTON	HARRIS	0508	01	292	487

1. **EXISTING**
 4-3" RMC (SUSPENDED BENEATH BRIDGE)
 IN COND. #1 - 1 SINGLE MODE FIBER OPTIC CABLE
 1 MULTIMODE FIBER OPTIC CABLE
 FIBER DROP CABLE
 1-6 PAIR #22 COMM. CABLE (VOICE COMM.)
 IN COND. #2 - 1-6 PAIR #22 COMM. CABLE (CCTV)
2. **EXISTING**
 JUNCTION BOX
 4-3" RMC (SUSPENDED BENEATH BRIDGE)
 IN COND. #1 - 1 SINGLE MODE FIBER OPTIC CABLE
 1 MULTIMODE FIBER OPTIC CABLE
 FIBER DROP CABLE
 1-6 PAIR #22 COMM. CABLE (VOICE COMM.)
 IN COND. #2 - 1-6 PAIR #22 COMM. CABLE (CCTV)



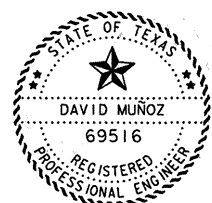
3. **EXISTING**
 4-3" CONDUITS
 IN COND. #1 - 1 SINGLE MODE FIBER OPTIC CABLE
 1 MULTIMODE FIBER OPTIC CABLE
 FIBER DROP CABLE
 1-6 PAIR #22 COMM. CABLE (VOICE COMM.)
 IN COND. #2 - 1-6 PAIR #22 COMM. CABLE (CCTV)

NO CTMS WORK ON THIS SHEET
 FOR INFORMATION ONLY

SEE SHEET 5 OF 12
 FOR LEGEND

SCALE: 1" = 100'

FILE NAME: IH-10-292-09.DGN



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8-3, 2007

David Muñoz, P.E.



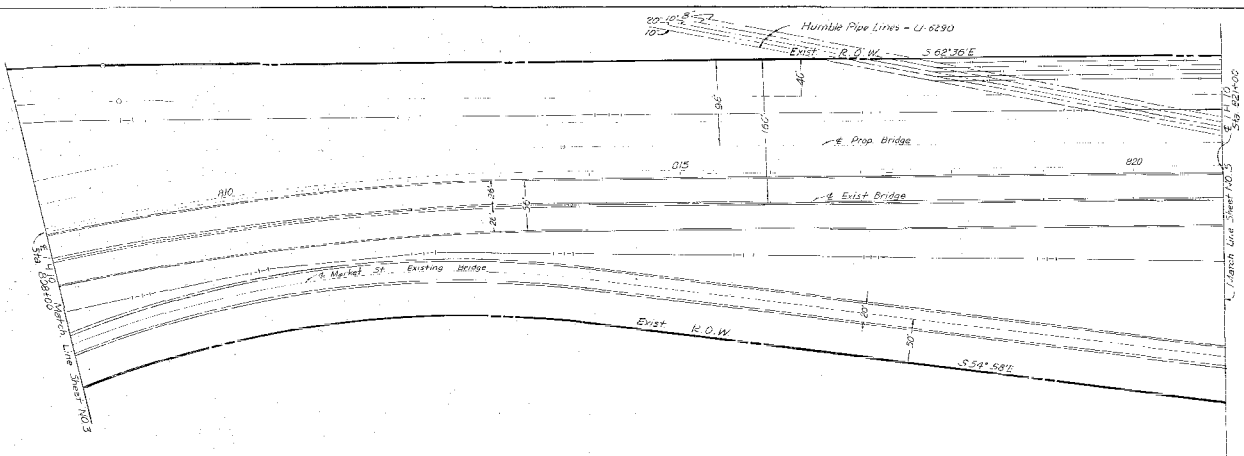
TEXAS DEPARTMENT OF TRANSPORTATION
 IH 10 (EAST FREEWAY)

COMPUTERIZED TRANSPORTATION
 MANAGEMENT SYSTEM LAYOUT

SHEET 9 OF 12

DN:	RFB	DRAWING	DATE	FED. RD.	STATE	PROJECT NO.	HIGHWAY NO.
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DW:	CCF						
CK DW:	SC						
TR:							
CK TR:							
				STATE DIST. NO.	COUNTY	CONTROL NO.	SECTION NO.
				HOUSTON	HARRIS	0508	01
							292
							490

177



HARRIS COUNTY
JOSIAH T. HARPELL SURVEY
A-330

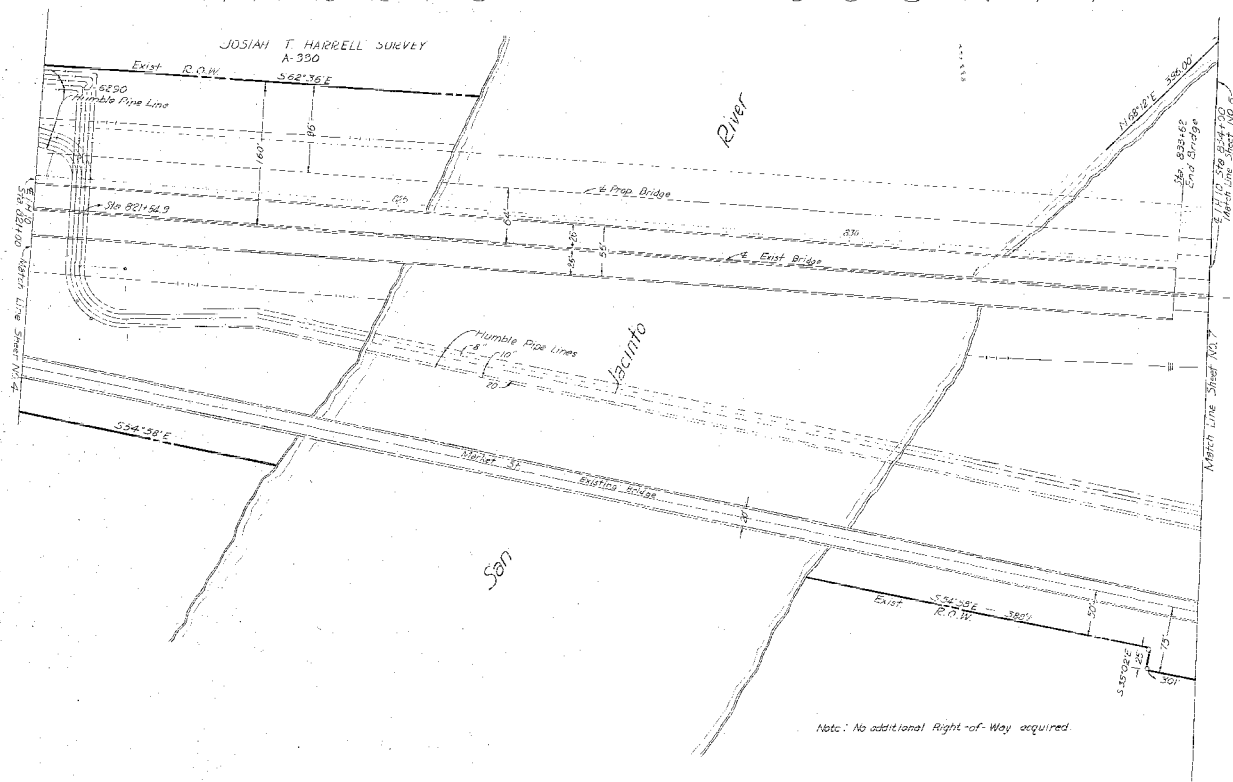
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Scale: 1" = 20'

Account 2012-3-1A

DATE	REASON	DATE	BY	STATE	COUNTY	PERMANENT NO.	100'
6	TEAS	1-10-11	1112	736	4		
12	HARRIS	301	7	187	11110		

C O U N T Y

NATHANIEL LYNCH SURVEY
A 44

B-47

5.

Scat. 1" = 10' Account 9212-3-18

Case No.	EXAMINER	DATE	FILE NO.	STATE	FEDERAL AND PROJECT NO.	FUND NO.
Q-10-1			1	TEXAS	1-10-7(117)796	5
Q-10-2			2	TEXAS		
Q-10-3			3	TEXAS		
Q-10-4			4	TEXAS		
Q-10-5			5	TEXAS		
Q-10-6			6	TEXAS		
Q-10-7			7	TEXAS		
Q-10-8			8	TEXAS		
Q-10-9			9	TEXAS		
Q-10-10			10	TEXAS		
Q-10-11			11	TEXAS		
Q-10-12			12	TEXAS		
Q-10-13			13	TEXAS		
Q-10-14			14	TEXAS		
Q-10-15			15	TEXAS		
Q-10-16			16	TEXAS		
Q-10-17			17	TEXAS		
Q-10-18			18	TEXAS		
Q-10-19			19	TEXAS		
Q-10-20			20	TEXAS		
Q-10-21			21	TEXAS		
Q-10-22			22	TEXAS		
Q-10-23			23	TEXAS		
Q-10-24			24	TEXAS		
Q-10-25			25	TEXAS		
Q-10-26			26	TEXAS		
Q-10-27			27	TEXAS		
Q-10-28			28	TEXAS		
Q-10-29			29	TEXAS		
Q-10-30			30	TEXAS		
Q-10-31			31	TEXAS		
Q-10-32			32	TEXAS		
Q-10-33			33	TEXAS		
Q-10-34			34	TEXAS		
Q-10-35			35	TEXAS		
Q-10-36			36	TEXAS		
Q-10-37			37	TEXAS		
Q-10-38			38	TEXAS		
Q-10-39			39	TEXAS		
Q-10-40			40	TEXAS		
Q-10-41			41	TEXAS		
Q-10-42			42	TEXAS		
Q-10-43			43	TEXAS		
Q-10-44			44	TEXAS		
Q-10-45			45	TEXAS		
Q-10-46			46	TEXAS		
Q-10-47			47	TEXAS		
Q-10-48			48	TEXAS		
Q-10-49			49	TEXAS		
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Q-10-70			70	TEXAS		
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Q-10-73			73	TEXAS		
Q-10-74			74	TEXAS		
Q-10-75			75	TEXAS		
Q-10-76			76	TEXAS		
Q-10-77			77	TEXAS		
Q-10-78			78	TEXAS		
Q-10-79			79	TEXAS		
Q-10-80			80	TEXAS		
Q-10-81			81	TEXAS		
Q-10-82			82	TEXAS		
Q-10-83			83	TEXAS		
Q-10-84			84	TEXAS		
Q-10-85			85	TEXAS		
Q-10-86			86	TEXAS		
Q-10-87			87	TEXAS		

HARRIS COUNTY

NATHANIEL LYNCH SURVEY
A-44

PARCEL 2
TRINITY PORTLAND CEMENT DIV.
GENERAL PORTLAND CEMENT CO.
Area of Tract 3.032 Ac.
Area of Taking .581 Ac.
Area of Remainder 2.451 Ac.
Judgment
Vol. 7569 Page 135

Note:
No additional Right-of-Way acquired
between stations 834+00 & 841+00
and stations 845+55 & 849+00 on
the Left side.

Rev. 1-31-68

DATE	BY	REVISION	DESCRIPTION
1-31-68	W. H. HARRIS	1	REVISION
1-31-68	W. H. HARRIS	2	REVISION
1-31-68	W. H. HARRIS	3	REVISION
1-31-68	W. H. HARRIS	4	REVISION
1-31-68	W. H. HARRIS	5	REVISION
1-31-68	W. H. HARRIS	6	REVISION
1-31-68	W. H. HARRIS	7	REVISION
1-31-68	W. H. HARRIS	8	REVISION
1-31-68	W. H. HARRIS	9	REVISION
1-31-68	W. H. HARRIS	10	REVISION

APPENDIX B

CONSTRUCTION DRAWINGS

TIME CRITICAL REMOVAL ACTION

SAN JACINTO RIVER WASTE PITS

SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency – Region 6

On behalf of:

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

TIME CRITICAL REMOVAL ACTION

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

CHANNELVIEW, HARRIS COUNTY, TEXAS

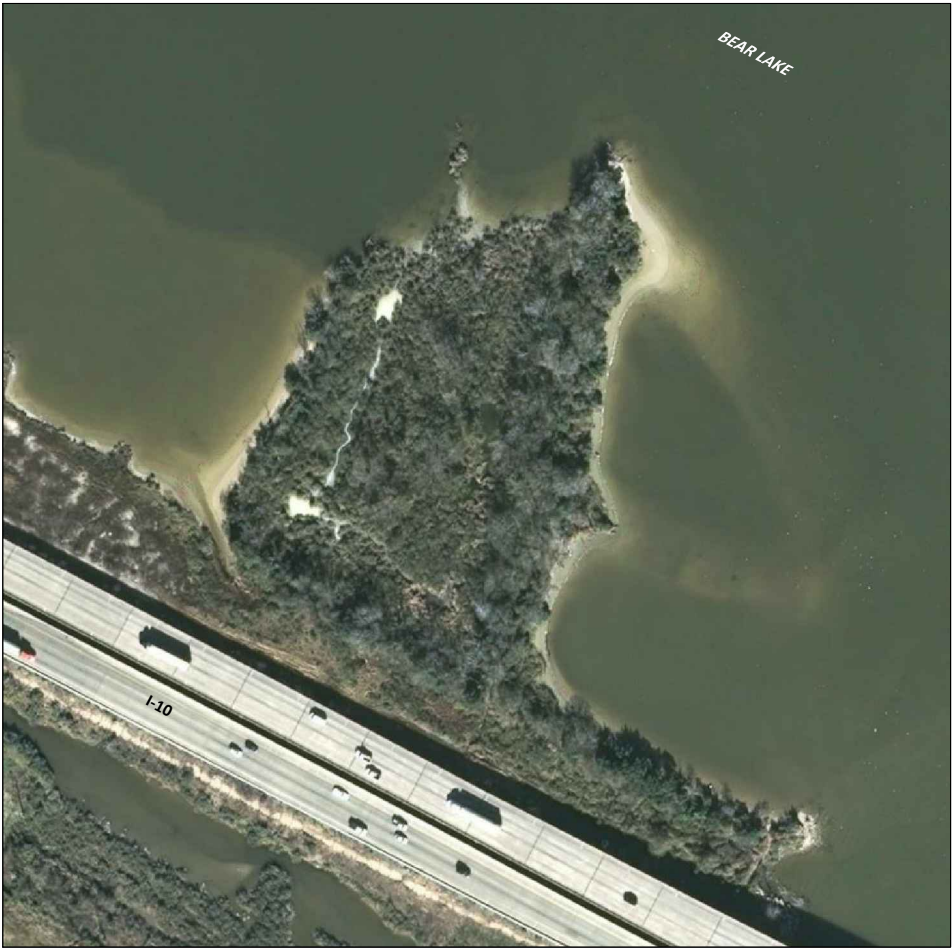
VICINITY MAP



GENERAL NOTES

1. THE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF PROJECT SPECIFICATIONS, PERMITS AND ALL APPLICABLE REGULATIONS AND ORDINANCES.
2. THE CONTRACTOR SHALL AT ALL TIMES KEEP ITS CONSTRUCTION AREAS FREE FROM ACCUMULATIONS OF WASTE MATERIALS OR RUBBISH; AND PRIOR TO COMPLETION OF THE WORK, THE CONTRACTOR SHALL REMOVE ANY RUBBISH FROM THE PREMISES AND ALL TOOLS, EQUIPMENT, AND MATERIALS NOT THE PROPERTY OF THE OWNER.
3. THE CONTRACTOR SHALL MAINTAIN SUITABLE VESSEL TRAFFIC SAFETY SIGNS, EQUIPMENT AND MANPOWER TO PROVIDE VESSEL TRAFFIC CONTROL. THE CONTRACTOR SHALL PROVIDE ALL LABOR AND EQUIPMENT NECESSARY TO MAINTAIN THE WATERWAYS FREE OF WASTE AND/OR DEBRIS RESULTING FROM PROJECT OPERATIONS.
4. OVERHEAD OR UNDERGROUND UTILITY LINES THAT MAY BE PRESENT ON OR NEAR THE PROPERTY ARE NOT SHOWN. CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF ALL UTILITY LINES.
5. FOR ALL SHEETS, HORIZONTAL DATUM IS TEXAS STATE PLANE SOUTH CENTRAL ZONE, NAD 83. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88). ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
6. TOPOGRAPHY AND BATHYMETRY HAS BEEN COMPILED FROM A FEBRUARY 16, 2009 AND JUNE 12, 2010 SURVEY CONDUCTED BY HYDROGRAPHIC CONSULTANTS, LTD OF BELLAIRE, TEXAS.

SITE MAP



DRAWING INDEX

SHEET SEQUENCE	SHEET NO.	SHEET TITLE
1	T-1	COVER SHEET
2	G-1	SURVEY CONTROL PLAN
3	C-1	GRADING PLAN (RESERVED)
4	C-2	CAPPING PLAN
5	C-3	CROSS SECTIONS
6	C-4	CROSS SECTIONS
7	C-5	CROSS SECTIONS
8	C-6	CROSS SECTIONS
9	C-7	DETAILS



614 MAGNOLIA AVENUE | OCEAN SPRINGS,
MS 39564 | (228) 818-9626

SAN JACINTO RIVER WASTE PITS
SUPERFUND SITE

TIME CRITICAL REMOVAL ACTION

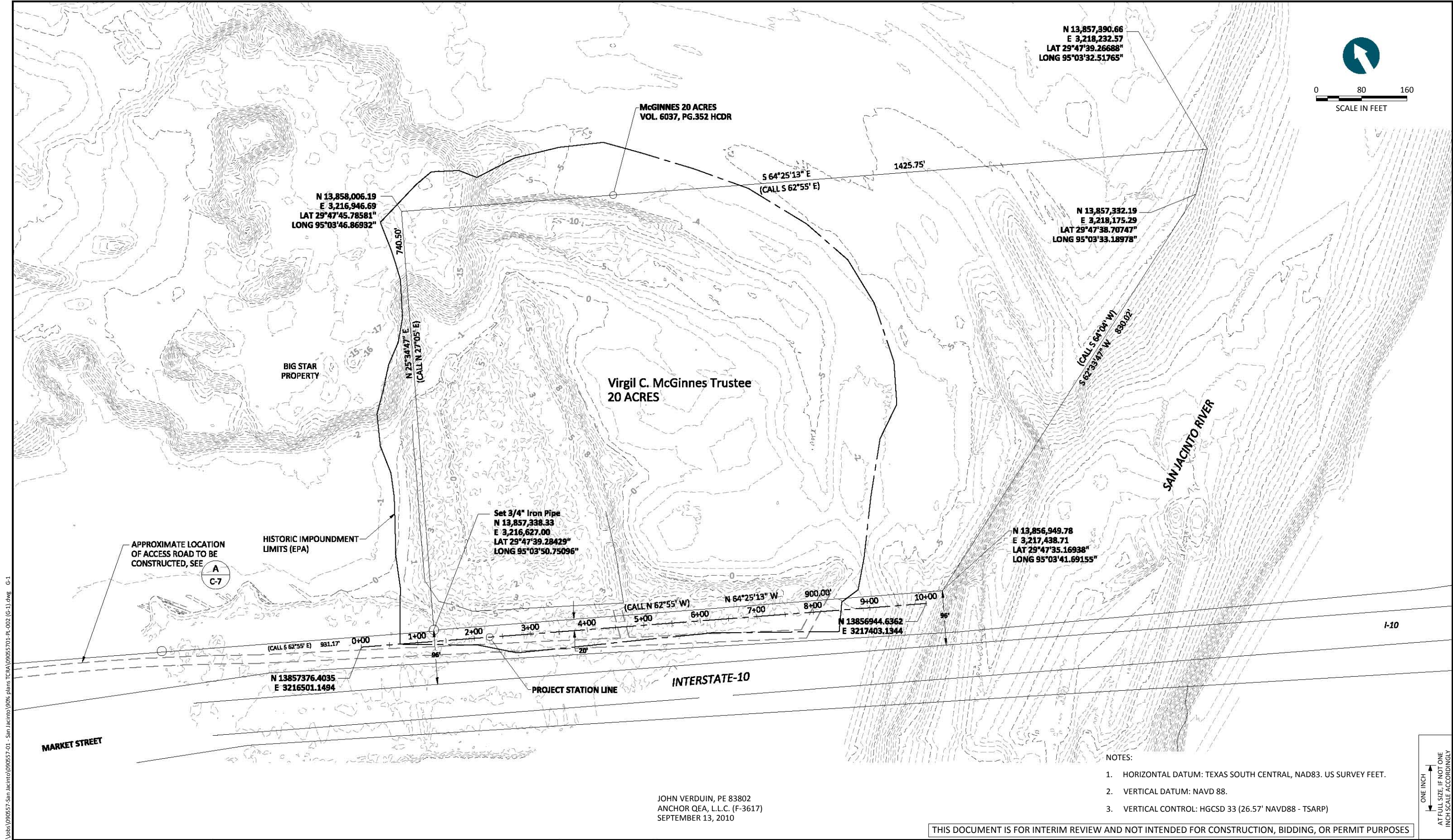
DESIGNED BY: W. MEARS / T. MERRITTS
DRAWN BY: G. HOWELL
CHECKED BY: T. MERRITTS
APPROVED BY: J. VERDUIN
SCALE: AS SHOWN
DATE: AUGUST, 2010

T-1

SHEET NO. 1 OF 9

JOHN VERDUIN, PE 83802
ANCHOR QEA, L.L.C. (F-3617)
SEPTEMBER 13, 2010

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JOHN VERDUIN, PE 83802
ANCHOR QEA, L.L.C. (F-3617)
SEPTEMBER 13, 2010

- NOTES:
1. HORIZONTAL DATUM: TEXAS SOUTH CENTRAL, NAD83. US SURVEY FEET.
 2. VERTICAL DATUM: NAVD 88.
 3. VERTICAL CONTROL: HGCS D 33 (26.57' NAVD88 - TSARP)

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REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: W. MEARS/T. MERRITS
DRAWN BY: G. HOWELL
CHECKED BY: J. VERDUIN
APPROVED BY: J. VERDUIN
SCALE: AS SHOWN
DATE: AUGUST, 2010

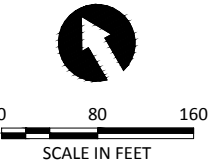
SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

SURVEY CONTROL

G-1

SHEET NO. 3 OF 9

Aug 26, 2010 2:35 PM JHowell k:\jobs\090557 San Jacinto\090557-01 - San Jacinto 90% plans TCBA\09055701 PL-004 (C-2).dwg C-2



- NOTES:
1. HORIZONTAL DATUM: TEXAS SOUTH CENTRAL, NAD83. US SURVEY FEET.
 2. VERTICAL DATUM: NAVD 88.

LEGEND:

CROSS SECTION LOCATION

EXISTING CONTOUR (1 FOOT INTERVAL)

PROPOSED CONTOUR PRIOR TO PLACING ARMORED CAP

	ARMORED CAP A	
	ARMORED CAP B	
	ARMORED CAP C	
	ARMORED CAP D	
	ARMORED CAP E	

JOHN VERDUIN, PE 83802
ANCHOR QEA, L.L.C. (F-3617)
SEPTEMBER 13, 2010

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REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: M. HENDERSON
DRAWN BY: G. HOWELL
CHECKED BY: J. VERDUIN
APPROVED BY: J. VERDUIN
SCALE: AS SHOWN
DATE: AUGUST, 2010

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

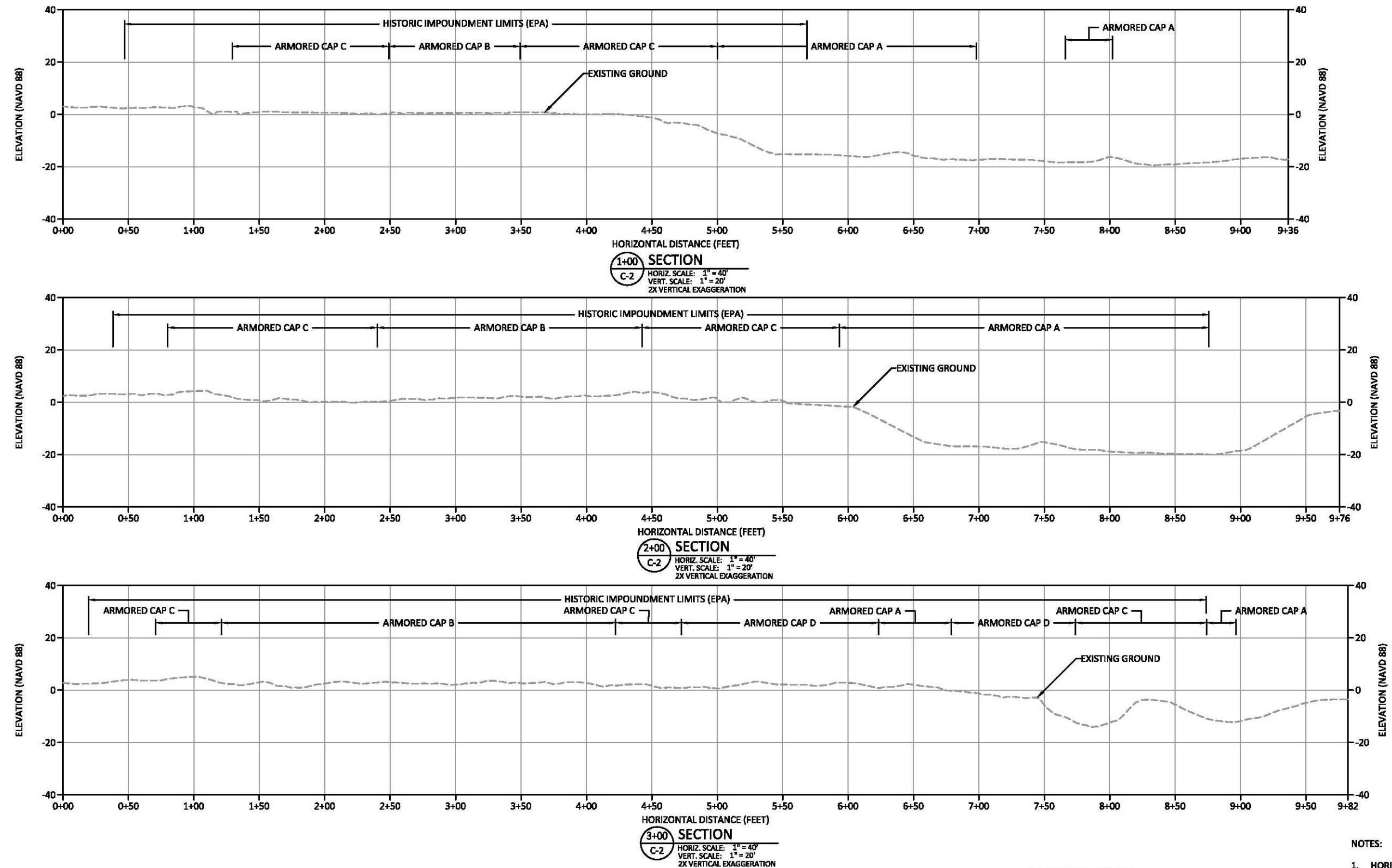
CAPPING PLAN

C-2

SHEET NO. 4 OF 9

ONE INCH
AT FULL SIZE, IF NOT ONE
INCH SCALE ACCORDINGLY

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NOTES:

1. HORIZONTAL DATUM: TEXAS SOUTH CENTRAL, NAD83, US SURVEY FEET.
2. VERTICAL DATUM: NAVD 88.

JOHN VERDUIN, PE 83802
ANCHOR QEA, L.L.C. (F-3617)
SEPTEMBER 13, 2010

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REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: W. MEARS/T. MERRITT
DRAWN BY: G. HOWELL
CHECKED BY: J. VERDUIN
APPROVED BY: J. VERDUIN
SCALE: AS SHOWN
DATE: AUGUST, 2010

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

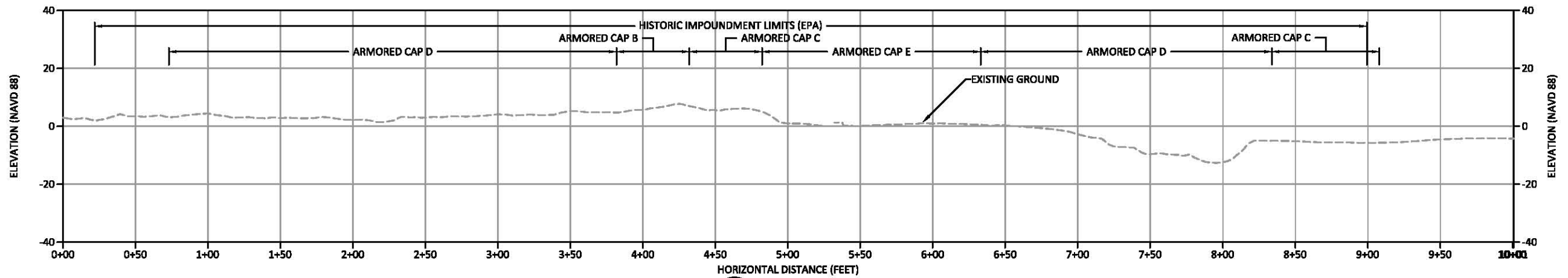
CROSS SECTIONS

C-3

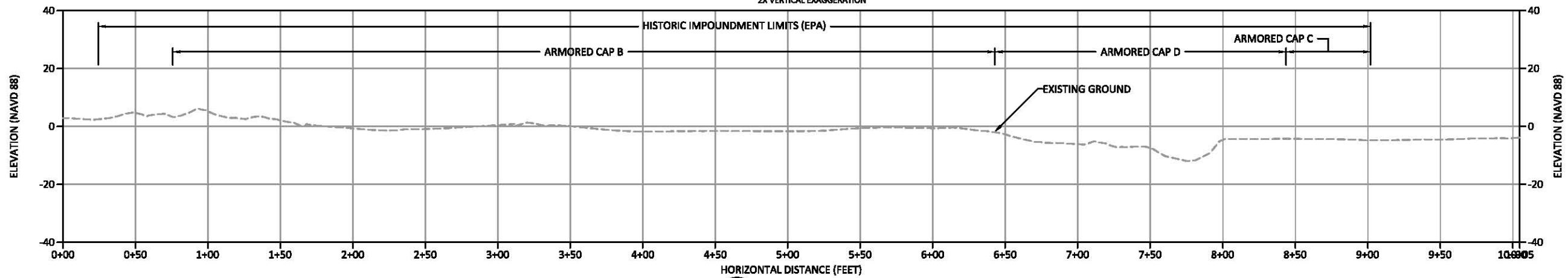
SHEET NO. 5 OF 9

ONE INCH
AT FULL SIZE, IF NOT ONE
INCH SCALE ACCORDINGLY

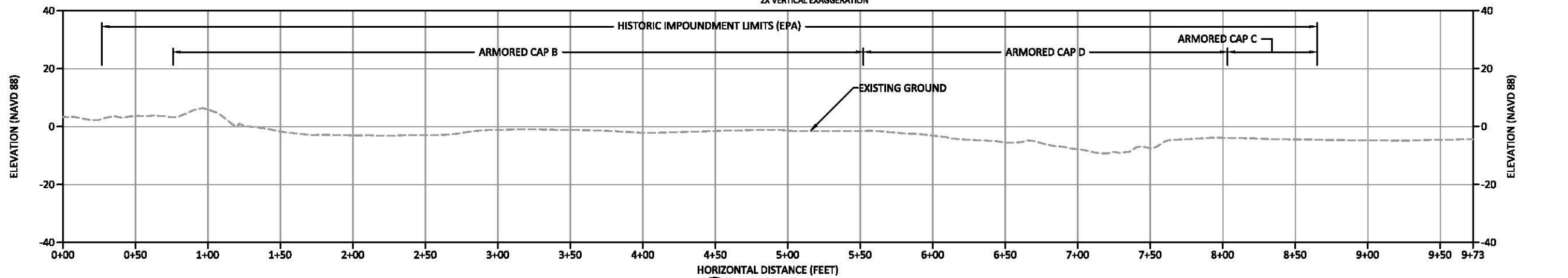
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4+00 SECTION
C-2
HORIZ. SCALE: 1" = 40'
VERT. SCALE: 1" = 20'
2X VERTICAL EXAGGERATION



5+00 SECTION
C-2
HORIZ. SCALE: 1" = 40'
VERT. SCALE: 1" = 20'
2X VERTICAL EXAGGERATION



6+00 SECTION
C-2
HORIZ. SCALE: 1" = 40'
VERT. SCALE: 1" = 20'
2X VERTICAL EXAGGERATION

- NOTES:
1. HORIZONTAL DATUM: TEXAS SOUTH CENTRAL, NAD83, US SURVEY FEET.
 2. VERTICAL DATUM: NAVD 88.

JOHN VERDUIN, PE 83802
ANCHOR QEA, L.L.C. (F-3617)
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DRAWN BY: G. HOWELL
CHECKED BY: J. VERDUIN
APPROVED BY: J. VERDUIN
SCALE: AS SHOWN
DATE: AUGUST, 2010

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

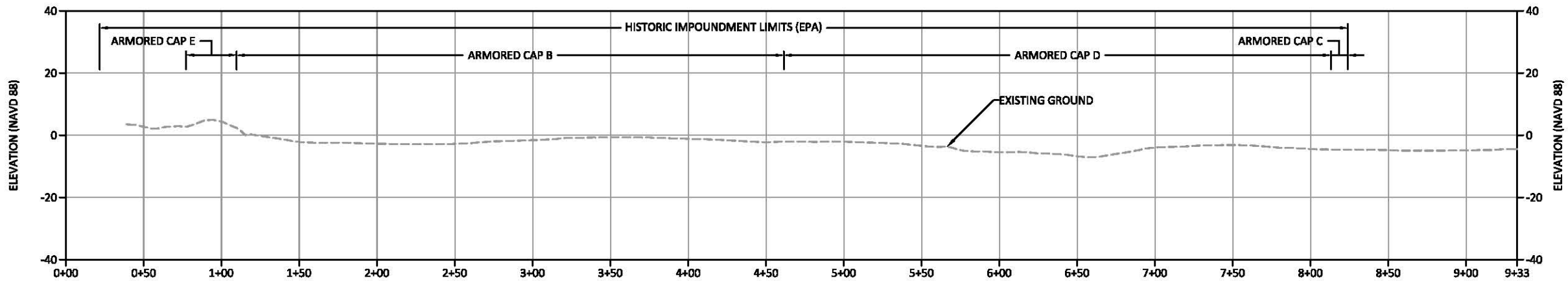
CROSS SECTIONS

C-4

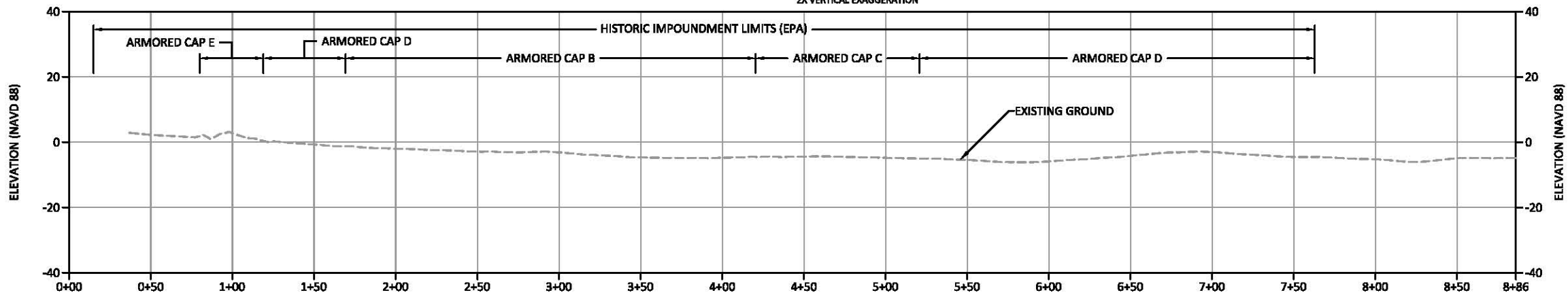
SHEET NO. 6 OF 9

ONE INCH
AT FULL SIZE, IF NOT ONE
INCH SCALE ACCORDINGLY

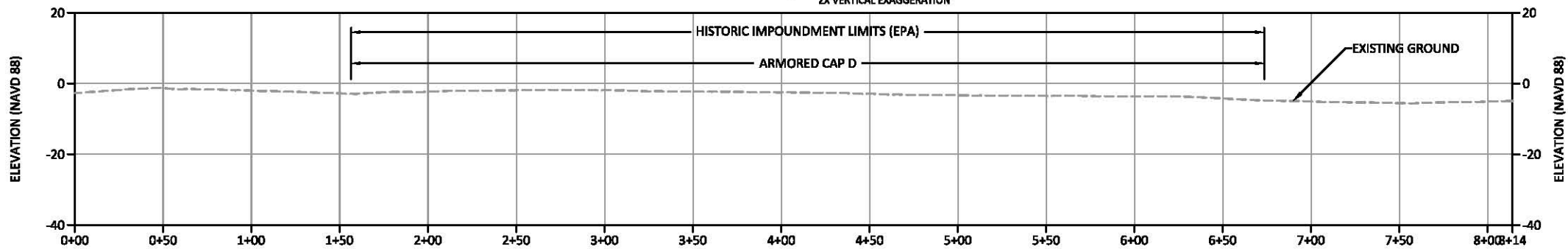
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7+00 SECTION
C-2
HORIZ. SCALE: 1" = 40'
VERT. SCALE: 1" = 20'
2X VERTICAL EXAGGERATION



8+00 SECTION
C-2
HORIZ. SCALE: 1" = 40'
VERT. SCALE: 1" = 20'
2X VERTICAL EXAGGERATION



9+00 SECTION
C-2
HORIZ. SCALE: 1" = 40'
VERT. SCALE: 1" = 20'
2X VERTICAL EXAGGERATION

JOHN VERDUIN, PE 83802
ANCHOR QEA, L.L.C. (F-3617)
SEPTEMBER 13, 2010

- NOTES:
1. HORIZONTAL DATUM: TEXAS SOUTH CENTRAL, NAD83, US SURVEY FEET.
 2. VERTICAL DATUM: NAVD 88.

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DRAWN BY: G. HOWELL
CHECKED BY: J. VERDUIN
APPROVED BY: J. VERDUIN
SCALE: AS SHOWN
DATE: AUGUST, 2010

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

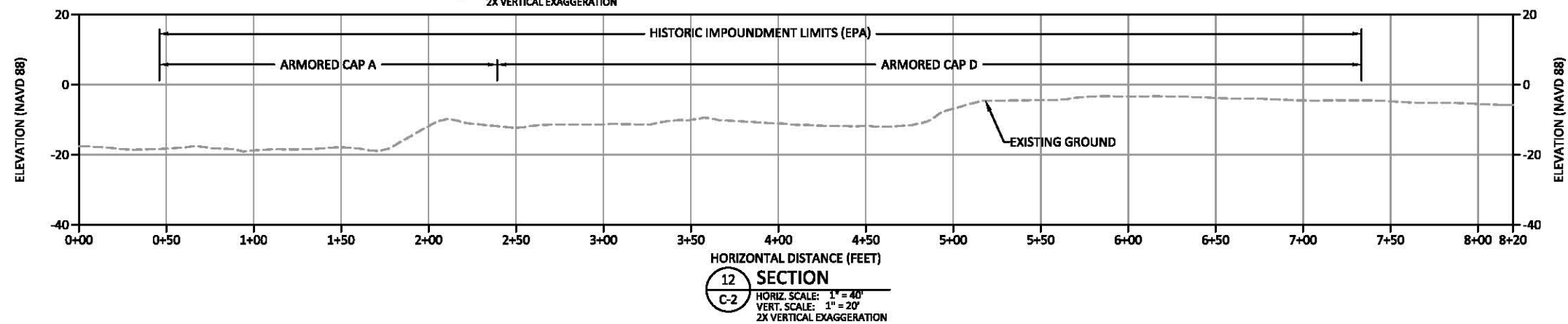
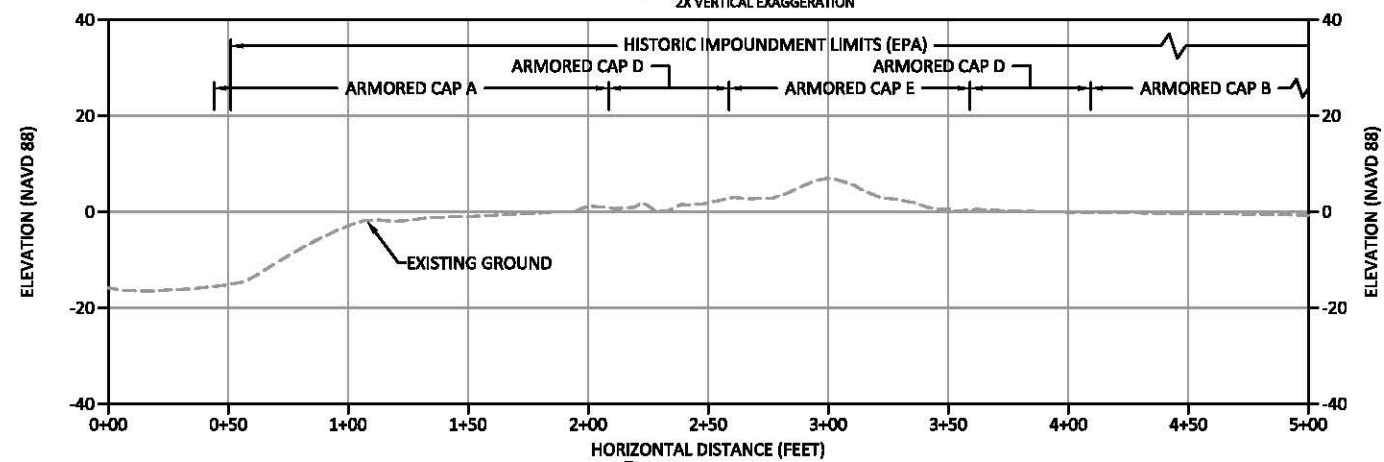
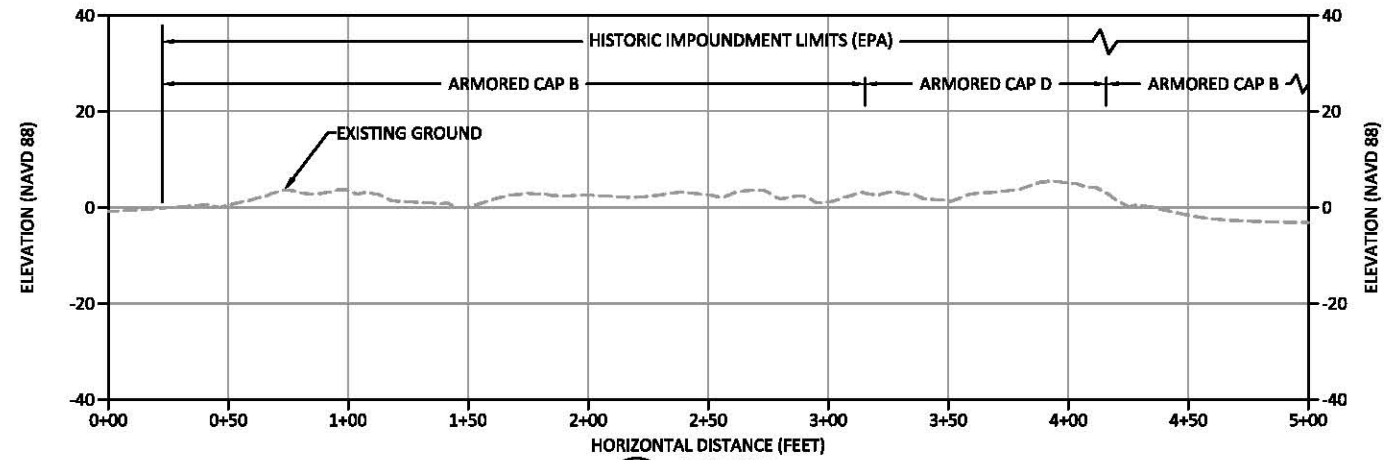
CROSS SECTIONS

C-5

SHEET NO. 7 OF 9

ONE INCH
AT FULL SIZE, IF NOT ONE
INCH SCALE ACCORDINGLY

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NOTES:

1. HORIZONTAL DATUM: TEXAS SOUTH CENTRAL, NAD83, US SURVEY FEET.
2. VERTICAL DATUM: NAVD 88.

JOHN VERDUIN, PE 83802
ANCHOR QEA, L.L.C. (F-3617)
SEPTEMBER 13, 2010

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REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: W. MEARS/T. MERRITS
DRAWN BY: G. HOWELL
CHECKED BY: J. VERDUIN
APPROVED BY: J. VERDUIN
SCALE: AS SHOWN
DATE: AUGUST, 2010

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

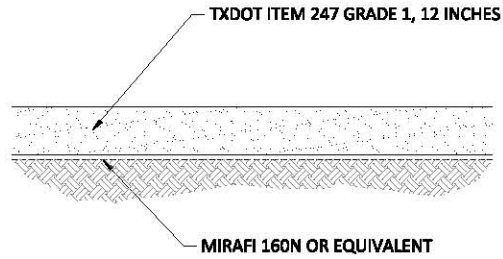
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C-6

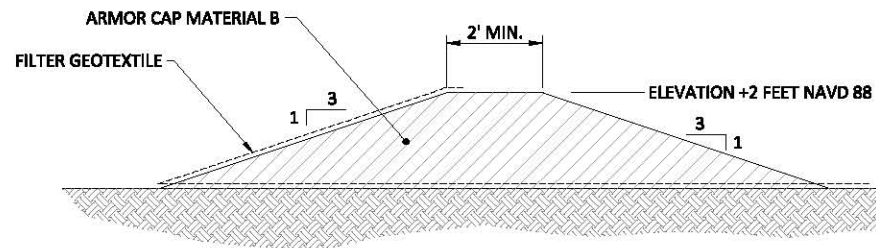
SHEET NO. 8 OF 9

ONE INCH
AT FULL SIZE, IF NOT ONE
INCH SCALE ACCORDINGLY

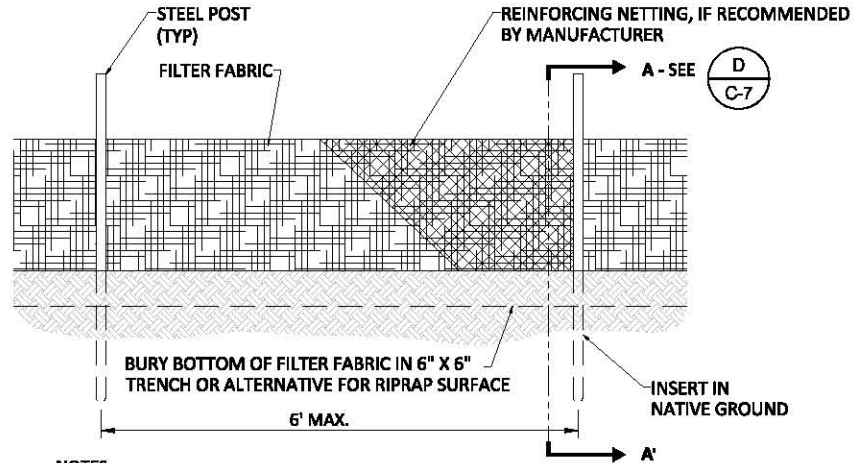
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A ACCESS ROAD
C-1 SCALE: NTS



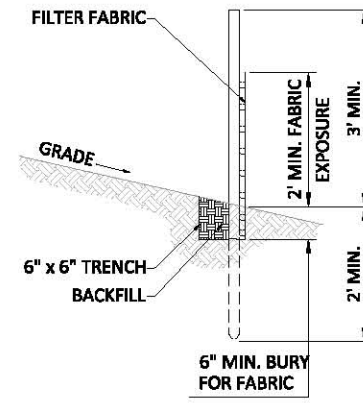
B TEMPORARY EROSION CONTROL BERM
C-1 SCALE: NTS



NOTES:

1. SILT FENCE MATERIAL SHOULD BE POLYPROPYLENE, POLYETHYLENE OR POLYAMIDE WOVEN OR NON-WOVEN FABRIC. THE FABRIC WIDTH SHOULD BE 36 INCHES, WITH A MINIMUM UNIT WEIGHT OF 4.5 OZ/YD, MULLEN BURST STRENGTH EXCEEDING 190 LB/IN 2, ULTRAVIOLET STABILITY EXCEEDING 70%, AND MINIMUM APPARENT OPENING SIZE OF U.S. SIEVE NO. 30.
2. FENCE POSTS SHOULD BE MADE OF HOT ROLLED STEEL, AT LEAST 4 FEET LONG WITH TEE OR Y-BAR CROSS SECTION, SURFACE PAINTED OR GALVANIZED, MINIMUM NOMINAL WEIGHT 1.25 LB/FT 2, AND BRINELL HARDNESS EXCEEDING 140.
3. WOVEN WIRE BACKING TO SUPPORT THE FABRIC SHOULD BE GALVANIZED 2" X 4" WELDED WIRE, 12 GAUGE MINIMUM.
4. SPLICE JOINTS AT SUPPORT POSTS ONLY, WITH A MIN. 6 IN. OVERLAP.
5. ANGLE ENDS OF SEDIMENT FENCE UPHILL TO ASSURE SOIL/SEDIMENT IS TRAPPED.

C SEDIMENT FENCE DETAIL - ELEVATION
C-1 SCALE: NTS

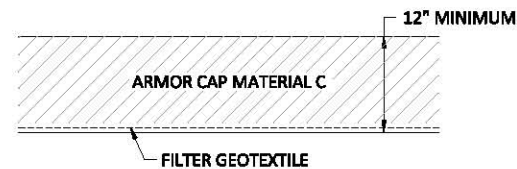


SECTION A-A'

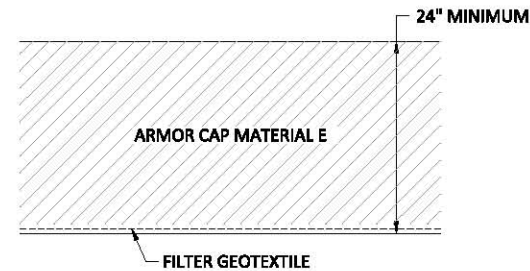
D SEDIMENT FENCE SECTION A-A'
C-1 SCALE: NTS



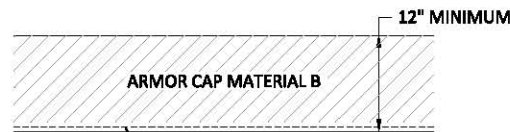
E ARMORED CAP A
C-2 SCALE: NTS



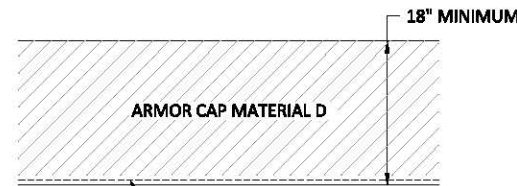
G ARMORED CAP C
C-2 SCALE: NTS



I ARMORED CAP E
C-2 SCALE: NTS



F ARMORED CAP B
C-2 SCALE: NTS



H ARMORED CAP D
C-2 SCALE: NTS

NOTES:

1. HORIZONTAL DATUM: TEXAS SOUTH CENTRAL, NAD83. US SURVEY FEET.
2. VERTICAL DATUM: NAVD 88.

JOHN VERDUIN, PE 83802
ANCHOR QEA, L.L.C. (F-3617)
SEPTEMBER 13, 2010

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REVISIONS					DESCRIPTION
REV	DATE	BY	APP'D		

DESIGNED BY: W. MEARS/T. MERRITTS
DRAWN BY: G. HOWELL
CHECKED BY: J. VERDUIN
APPROVED BY: J. VERDUIN
SCALE: AS SHOWN
DATE: AUGUST, 2010

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

DETAILS

C-7

SHEET NO. 9 OF 9

APPENDIX C

PERIMETER FENCE CONSTRUCTION DRAWINGS

TIME CRITICAL REMOVAL ACTION SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-028.dwg Ex A-1
Mar 30, 2010 2:49pm heriksen



K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-028.dwg Ex A-2
Mar 30, 2010 2:42pm heriksen



Exhibit B

Fence Installation, Operation, Maintenance and Removal – Site Fencing Area

Installation

The fence will meet or exceed Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, adopted by the Department June 1, 2004, item 550 chain link fencing. In general, the fence alignment will follow the alignment(s) shown on Figure B-1, which is attached, and will provide gated access north and south of the I-10 highway.

Operation and Maintenance

The fence and gates will be maintained by the Licensees for their use, including providing controlled access to their contractors, the Department, and appropriate regulatory agencies. The fence and access gates will be inspected monthly for damage and repaired or replaced in a timely manner.

Access through the gates will be restricted with locks. A separate lock with a combination or key will be provided to the Department for access to the work area. The Licensees request 24-hour written notice (or email) prior to entry to the Site Fencing Area for litter and debris removal, mowing and maintenance activities for compliance with the Site Health and Safety Plan. The Licensees will be responsible for removal of all litter, debris, and erosion control measures employed and related to their construction activities.

The Licensees will compile and provide the Department with a photographic report of the Site Fencing Area conditions before installing the fence and after removal.

Notifications

All notifications under this Exhibit B shall be made to the Licensees' designated representatives as follows:

McGinnes Industrial Maintenance Corporation:

Mr. Francis E. Chin
Sr. Counsel Regulatory/HSE
1001 Fannin Street, Suite 4000
Houston, Texas 77002
Tel: 713-328-7187
Fax: 713-287-2654
fchin@wm.com

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9590 Clay Road

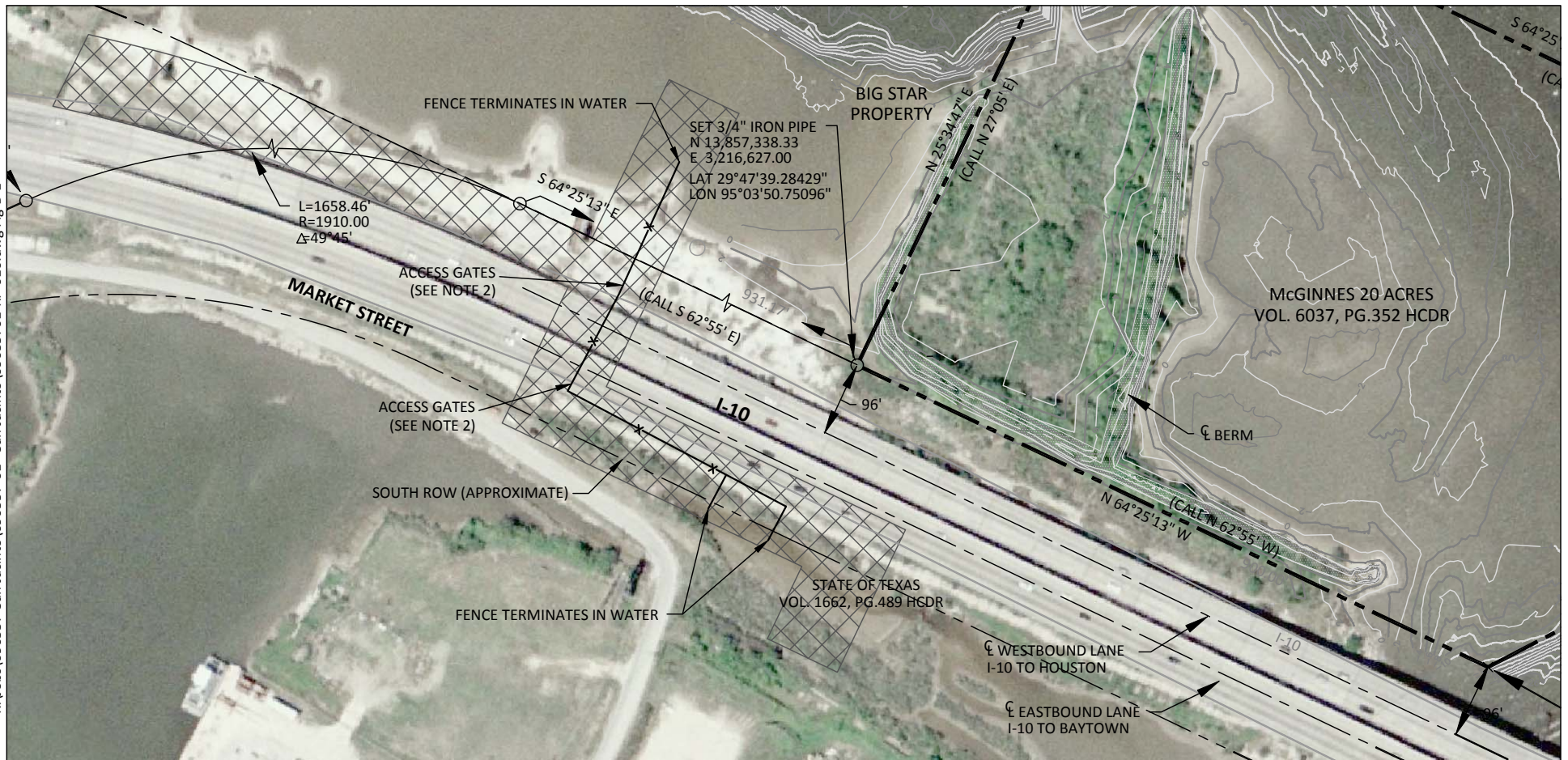
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Tel: 310-442-8885
Fax: 310-820-8859
jcermak@bakerlaw.com



SOURCE: Martin Survey Associates, Inc. survey dated 2/23/2010 - 3/01/2010.

NOTES:

1. The fence will be specified as 8-foot tall, 2-inch mesh material with top rails and line posts on 10-foot centers with concrete footings. Terminal posts will be trussed and braced.
2. Access gates will be two 12-foot wide leafs, providing a 24-foot opening.
3. Three strands of barbed wire on a pressed arm will be installed along the top of the fence and gates, making the completed system 9-feet tall.

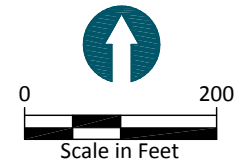
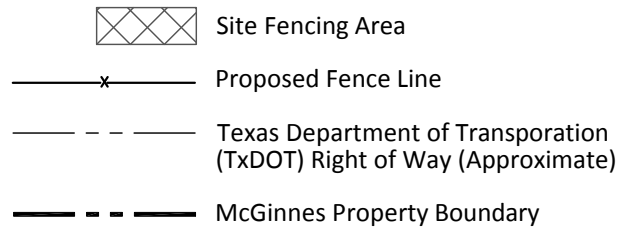


Exhibit C

Fence Installation, Operation, Maintenance and Removal – River Fencing Area

Installation

The fence installation will meet or exceed the Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, adopted by the Department June 1, 2004, item 550 chain link fencing. In general, the fence alignment will follow the alignment(s) shown on Figure C-1, which is attached, and provide two gated access south of the I-10 highway.

Operation and Maintenance

The fence installed in the River Fencing Area is intended solely to prevent public access to the area for recreational activities, including fishing. No work is planned in the area by the Licensees. The fence and gates will be maintained by the Licensees for their use, providing controlled access to their contractors for maintenance purposes, appropriate regulatory agencies, the Department, and the Coastal Water Authority (CWA). The fence and access gate(s) will be inspected monthly for damage and repaired or replaced in a timely manner.

Access through the gates will be restricted with locks. A separate lock with a combination or key will be provided to the Department and CWA for access to the River Fencing Area.

The Licensees will compile and provide the Department with a photographic report of the River Fencing Area conditions before installing the fence and after removal.



SOURCE: Martin Survey Associates, Inc. survey dated 2/23/2010 - 3/01/2010.

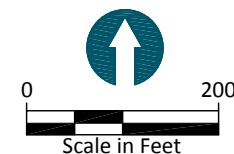
NOTES:

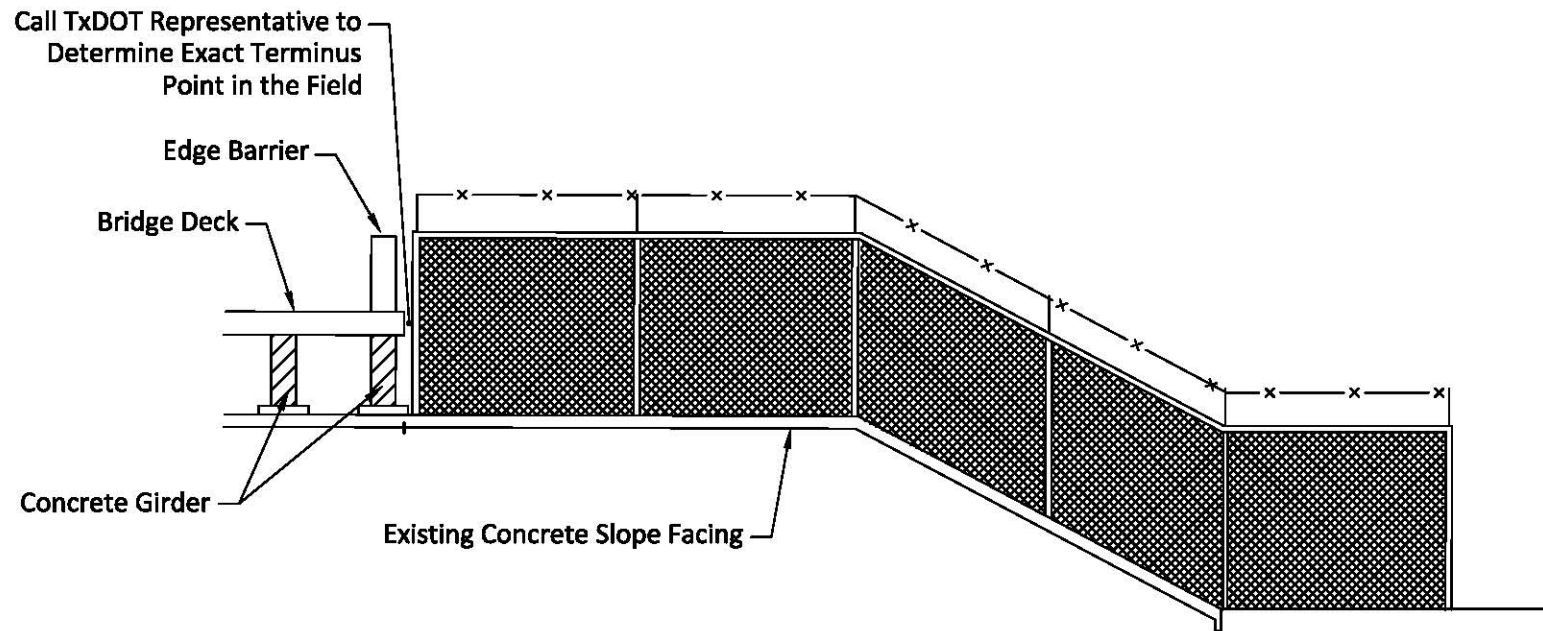
1. The fence will be specified as 8-foot tall, 2-inch mesh material with top rails and line posts on 10-foot centers with concrete footings. Terminal posts will be trussed and braced.
2. Access gates will be two 12-foot wide leafs, providing a 24-foot wide opening.
3. Three strands of barbed wire on a pressed arm will be installed along the top of the fence and gates, making the completed system 9-feet tall.
4. The fence shall abut but not attach or touch TxDOT bridge. See detail on figure C-2.

—*—*—*— Proposed Fence Line



River Fencing Area





Not to Scale

TES:

- . The fence will be specified as 8-foot tall, 2-inch mesh material with top rails and line posts on 10-foot centers with concrete footings. Terminal posts will be trussed and braced.
- . Three strands of barbed wire on a pressed arm will be installed along the top of the fence and gates, making the completed system 9-feet tall.
- . Fence post shall be flanged and anchor bolted to existing TxDOT apron.
- . Cable stays or other horizontal reinforcement shall be utilized to support fencing.



OPERATION OR PARKING OF VEHICLES UNDER OR WITHIN 10 FEET OF I-10 BRIDGES IS PROHIBITED.

Figure C-2
Detail For Tie to TxDOT on East Bank
San Jacinto River Waste Pits Site

APPENDIX D

WATER QUALITY MONITORING PLAN

TIME CRITICAL REMOVAL ACTION

SAN JACINTO RIVER WASTE PITS

SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

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LIST OF ACRONYMS AND ABBREVIATIONS

BMP	best management practice
CQAO	Construction Quality Assurance Officer
GPS	global positioning system
NTU	nephelometric turbidity units
TCRA	time critical removal action
USEPA	U.S. Environmental Protection Agency
WQMP	Water Quality Monitoring Plan

1 INTRODUCTION

This document presents a Draft Water Quality Monitoring Plan (WQMP) for the time critical removal action (TCRA) at the San Jacinto River Waste Pits Superfund Site in Harris County, Texas (Figure 1-1). The purpose of performing the monitoring described in this WQMP is to detect changes in-water quality associated with the implementation of TCRA that could result in unacceptable exposure to human and ecological receptors or deposition of contaminated sediment outside the project area.

The TCRA includes the following shoreline and in-water components:

- Clear and grub areas where grading and/or the armored cap will be constructed.
- Install erosion control measures around the Site.
- Cut and fill materials on the Site to meet the design grades. The cutting and filling will occur primarily in the western cell.
- Install a separation geotextile over a majority of the Site where the armored cap is to be constructed.
- Construct the armored cap across the Site.

The remainder of this document provides the following information related to water quality monitoring during construction:

- **Section 2 – Water Quality Monitoring Program** describes the monitoring objectives, monitoring approach, compliance boundaries, station locations and depths, and applicable water quality criteria.
- **Section 3 – Sampling and Analysis Methods** describes the details of sampling and analysis including station identification, sample location and depth control, monitoring methods and equipment, monitoring equipment calibration, and maintenance and measurement documentation.
- **Section 4 – Reporting Requirements** describes the requirements for water quality data submittals and documentation required for the completion report.
- **Section 5 – Monitoring Personnel and Key Contacts** details the responsibilities of key monitoring personnel.

2 WATER QUALITY MONITORING PROGRAM

The objective of water quality monitoring during the TCRA construction activities is to confirm that water quality criteria are met. To meet this objective, water quality monitoring will occur during the in-water construction activities described in Section 1.

The details of the water quality monitoring program—including monitoring parameters, compliance boundary locations, monitoring station locations and depths, monitoring schedules, and applicable water quality criteria—are described below.

2.1 Monitoring Parameter

Turbidity (in nephelometric turbidity units [NTU]) will be monitored during TCRA construction activities.

2.2 Compliance Boundaries

The proposed compliance boundary for turbidity is 500 feet downcurrent of the project boundary (see Figure 2-1). The proposed compliance boundary is consistent with previous water quality monitoring in the region and is designed to monitor the effects of TCRA activity on the quality of water passing the Site.

2.3 Water Quality Monitoring Criteria

The water quality monitoring criteria presented in this section will form the basis for evaluating water quality at the compliance boundary. The State of Texas does not provide a quantitative surface water quality standard for turbidity. The following criteria are consistent with Oregon state water quality standards [OAR 340-041-036] and have been protective of human health and ecology on similar projects.

The following turbidity criteria will apply at the compliance boundary:

- Turbidity should not exceed 5 NTUs above background if background is less than 50 NTUs.
- Turbidity should not exceed 10 percent above background if background is greater than 50 NTUs.

- Turbidity exceedances at the compliance boundary will trigger contingency response actions as specified in Section 2.6.

2.4 Monitoring Station Locations and Depths

Flow reversals as a result of tides are common during low-flow periods. The field crew will use a tide chart to help determine flow direction. Background and compliance measurements will be taken upcurrent and downcurrent of the project Site, respectively. Upstream and downstream compliance monitoring stations will be placed at their respective boundaries as shown on Figure 2-1. In addition to the monitoring stations at the compliance boundary, three “early warning” stations will be symmetrically placed 250 feet from the center of construction (Figure 2-1). Two stations will also be utilized for ongoing monitoring as background stations, one located 1,000 feet upstream of the project Site and one located 1,000 feet downstream of the project Site. Coordinates of the background and compliance stations are provided in Table 2-1.

Table 2.1
Monitoring Station Coordinates

Monitoring Station	Northing	Easting
B-U	13859001	3216707
C-U	13858517	3216836
C-D	13856461	3217124
B-D	13856014	3216900

Horizontal Datum: Texas South Central, NAD83, US Survey Feet.

At each station, monitoring will occur at three depths (if the water depth is greater than 10 feet):

- Surface – 3 feet below the water surface
- Middle – Center of the water column
- Bottom – 3 feet above the sediment bottom

If the water depth is less than 10 feet, monitoring will occur at the middle depth only.

2.5 Monitoring Frequency and Schedules

The frequency and schedule of the monitoring during the in-water work is divided into three distinct tiers as described below:

- *Intensive* – Collection of turbidity measurements every four hours during in-water work beginning one hour after start of work.
- *Routine* – Collection of turbidity measurements once daily during in-water work
- *Limited* – Collection of turbidity only if turbidity plumes are visually evident during in-water work

Monitoring will be conducted on an intensive schedule for the first two days of in-water work. If no exceedances occur during the intensive monitoring, monitoring will be reduced to a routine schedule for two additional days. If no exceedances occur during routine monitoring, monitoring will be reduced to a limited schedule for the remaining days. The occurrence of exceedances or visual turbidity observations will trigger a transition back to intensive monitoring to determine if water quality impacts have occurred.

2.6 Responses to Water Quality Exceedances

2.6.1 250-foot Station

If turbidity measurements at the 250-foot “early warning” station are measured above the criteria as listed in Section 2.3, the following sequence of responses will be initiated:

1. If an initial exceedance is measured at the 250-foot boundary, the sampler will wait 5 to 10 minutes and retake measurements at the station. The sampler will visually assess the station vicinity for potential outside influences.
2. If water quality passes the turbidity criteria, the sampling crew will move to the next 250-foot station.
3. If the station water quality turbidity standard exceedance is confirmed (two measurements in 5 to 10 minutes), the CQAO and the contractor will be notified and the contractor will modify work activity using best management practices (BMPs). BMPs are discussed in further detail in the Removal Action Work Plan (RAWP). The team will evaluate the current work to determine if adjustments can be made to correct the problem. The sampler will wait 30 minutes to 1 hour and retake measurements at the 250-foot station.

4. If no exceedances are confirmed at any 250-foot station after 30 minutes to 1 hour, the sampler will continue sampling at normal 4-hour increments.
5. If exceedances continue, move to the 500 foot compliance station.

2.6.2 500-foot Station

If turbidity values at the 250-foot early warning stations are below the criteria listed in Section 2.3, no measurements will be taken at the 500-foot station. However, if turbidity values at the 250-foot early warning stations exceed the criteria after repeated measurements described in Section 2.6.1, measurements will be made at the 500-foot compliance boundary and the following sequences of responses will be initiated:

1. If an initial exceedance is measured at the 500-foot compliance boundary, the sampler will wait 5 to 10 minutes and retake measurements at the station. The sampler will visually assess the station vicinity for potential outside influences.
2. If turbidity is less than the criteria, the sampling crew will move to the next station.
3. If the station water quality turbidity standard exceedance is confirmed (two measurements in 5 to 10 minutes), the Engineer will be alerted. The contractor shall take appropriate corrective action (beyond those taken to modify the work activity for 250-foot exceedances) as necessary in order to meet turbidity standards.
4. The sampler will wait 30 minutes to 1 hour and retake measurements at the 500-foot station.
5. If no exceedances are confirmed at the 500-foot station after 30 minutes to 1 hour, the sampler will continue sampling at normal 4 hour increments, following the 250-foot sampling protocol, as identified in Section 2.6.1.

In the event of two confirmed exceedances at the 500-foot compliance boundary occurring during two consecutive measurements (4 hours apart), the Engineer and the monitoring team shall:

- Immediately take action to stop the activity causing the excessive turbidity
- Discontinue any additional in-water work until the problem is resolved

2.7 Quality Assurance

The quality assurance objective for this project is to collect data that are of known and acceptable quality so that the goals of the water quality program can be achieved.

Appropriate field quality control procedures will be followed. These procedures include performing routine field instrument calibration and following standard instrument operation procedures described in Section 3.5.

3 MONITORING METHODS

3.1 Methods and Equipment

Turbidity and other field parameters will be measured using a calibrated field instrument deployed to the appropriate depth (surface, middle, and bottom intervals) as described in Section 2.4.

3.2 Monitoring Location and Depth Control

A global positioning system (GPS) will be used to navigate to and verify station locations. Monitoring will take place within 20-feet of the target monitoring locations. Depth to the bottom will be determined using a lead line or depth sounder. From this measurement, the appropriate sampling depths will be determined. Both the depth to the bottom and the sampling depths will be recorded at each location sampled.

3.3 Measurement Identification

All measurements will be properly identified on all forms and documentation. All measurements will be consistent with the following identification scheme consisting of 11 alphanumeric characters:

1. The first two characters will be “SJ” to identify the samples as San Jacinto TCRA measurements.
2. The next character will be used to identify each water quality monitoring location as listed below:
 - E = 250-foot early warning station
 - C = 500-foot compliance station
 - B = 1,000-foot background station
3. The next character will be a letter (U, D, C) indicating the position relative to the center of construction:
 - U = station located upstream of center of construction
 - D = station located downstream of center of construction
 - C = station located channel-ward of center of construction

-
4. The next character will indicate the sampled water depth category as described below:
 - A = surface measurement taken within 3 feet of the surface
 - B = measurement taken at mid-depth
 - C = bottom measurement taken 3 feet from the sediment surface
 5. The last 6 characters will indicate the measurement date by YYMMDD.

For example, following this identification scheme, SJ-B-U-B-100920 indicates a middle depth measurement collected during the San Jacinto TCRA construction at the upstream background location on September 20, 2010.

3.4 Measurement Documentation

The water quality monitoring data (e.g., station coordinates, water depths sampled, date, time, flow direction, parameter results, and other observations) will be recorded on water quality monitoring forms (Attachment D-1).

3.5 Monitoring Equipment Calibration and Maintenance

A Hach Hydrolab Self Cleaning Turbidity sensor or equivalent will be used to collect field measurements. The turbidity meter will be calibrated prior to its use in the monitoring program following manufacturers' instructions. The calibration will be conducted once at the beginning of each sampling day for all equipment. Where not covered by manufacturers' instructions, calibration procedures will follow Standard Method 2130-b (turbidity) (AWWA 1998).

At the end of each day of monitoring, a post-calibration procedure will be performed by measuring one of the calibration standards (preferably the standard whose value is closest to the river turbidity during that day). In addition, standards may be measured to check the calibration throughout the day, especially if higher or lower than expected turbidity values occur. All calibration information will be recorded in the field notebook. Equipment that does not properly calibrate will not be used.

Instruments and equipment will be tested and inspected before each monitoring event. Any field equipment that is faulty or not functioning properly will not be used for monitoring.

3.6 Health and Safety Procedures

Health and safety procedures for water quality monitoring activities are provided in Appendix F of the RAWP.

4 REPORTING REQUIREMENTS

4.1 Data Submittals

Data will be collected and recorded in the field on the water quality monitoring forms. These data will be reported to U.S. Environmental Protection Agency (USEPA) in the following communications and submittals:

- **Weekly Reporting** – Results from each week’s Water Quality Monitoring Forms will be summarized and submitted to USEPA on a weekly basis. Summaries will report whether any exceedances of the water quality standards were observed and describe any response actions taken.
- **Final Reporting** – Once all construction is complete, results for the entire construction period will be compiled and reported to USEPA along with supporting documentation in the draft and final completion report.

Weekly reporting will be conducted by the Water Quality Monitoring Field Leader. All reporting will include both regularly scheduled monitoring and any additional monitoring results that may have been triggered by exceedances of water quality criteria.

4.2 Completion Report

After all construction is complete, the results of water quality monitoring will be provided to USEPA in the draft completion report. The discussion of the water quality monitoring efforts in the completion report will include:

- Any deviations from this WQMP and reasons for deviations
- Tabular summaries of all water quality monitoring data with comparisons to compliance criteria and trigger values
- Narrative text on results of water quality monitoring
- Discussion of water quality criteria exceedances and any additional monitoring that may have resulted, or additional construction BMPs that may have been implemented

5 MONITORING PERSONNEL AND KEY CONTACTS

Personnel to fulfill the following roles will be designated at least 1 week prior to the start of the first monitoring events:

- Water Quality Monitoring Field Leader
- Monitoring personnel
- Construction Quality Assurance Officer (CQAO)
- USEPA Project Coordinator – Valmichael Leos (for receipt of reports)

Contact information for key personnel will be provided once personnel assignments have been made. All monitoring personnel in these roles will be experienced in the collection and measurement of water quality parameters.

The Water Quality Monitoring Field Leader is responsible for:

- Oversight of all water monitoring activities
- Verification that results are properly recorded and forms are completely filled out
- Verification that appropriate calibration and quality control and assurance procedures are conducted
- Notification to CQAO in the event that water quality triggers are exceeded
- Reporting of water quality results to USEPA's designated contact

Monitoring personnel are responsible for conducting the field activities, necessary calibrations, quality assurance and quality control procedures, and recording of results as directed by the Water Quality Monitoring Field Leader.

The CQAO is responsible for acting upon water quality information as provided by the Water Quality Monitoring Field Leader as necessary.

6 REFERENCES

American Water Works Association (AWWA), 1998. Standard Methods for the Examination of Water and Wastewater. 20th edition. American Public Health Association, Water Pollution Control Federation, Washington, DC, U.S.

FIGURES

K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-049.dwg FIG 1-1
Aug 30, 2010 8:51am cdavidson

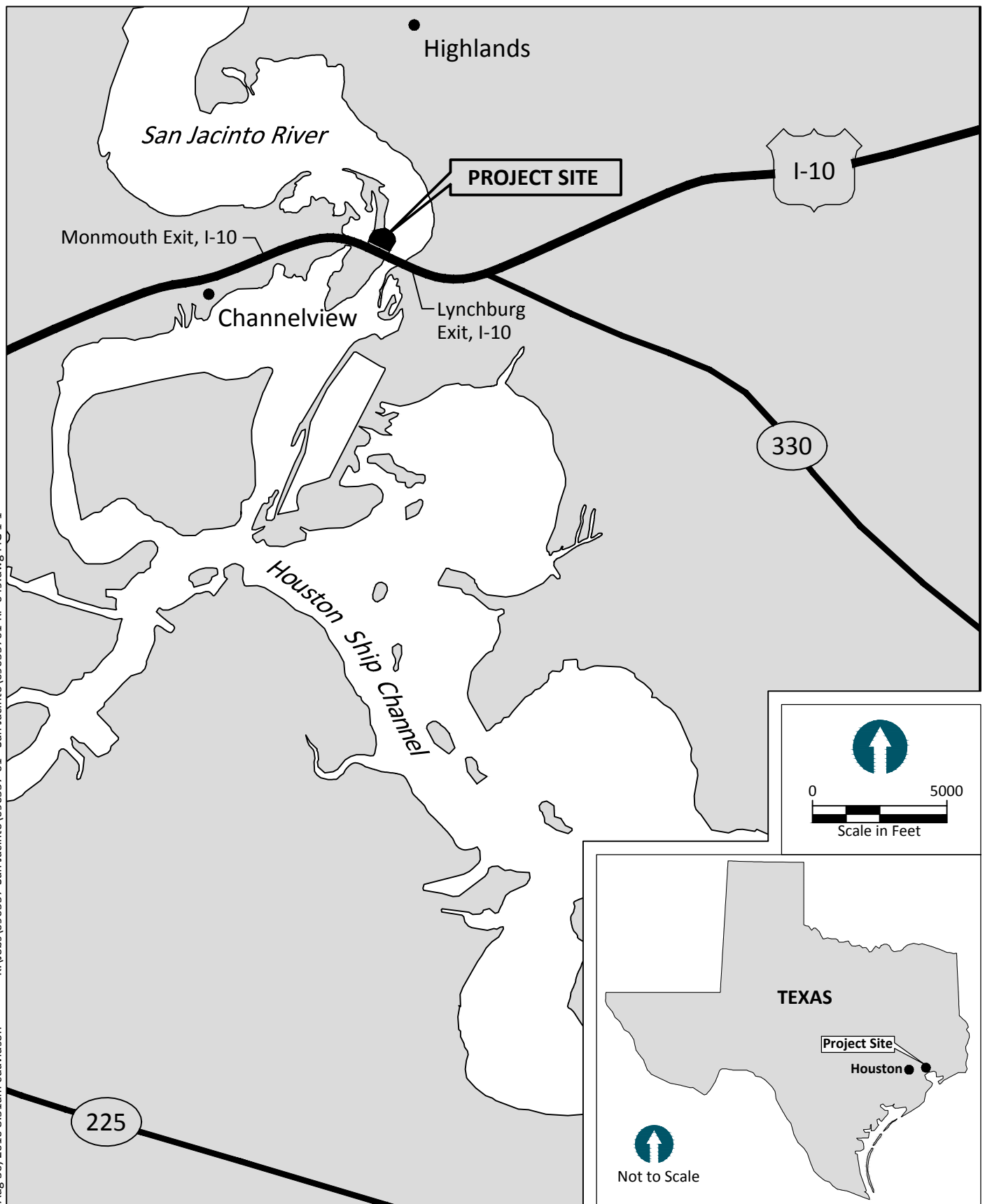
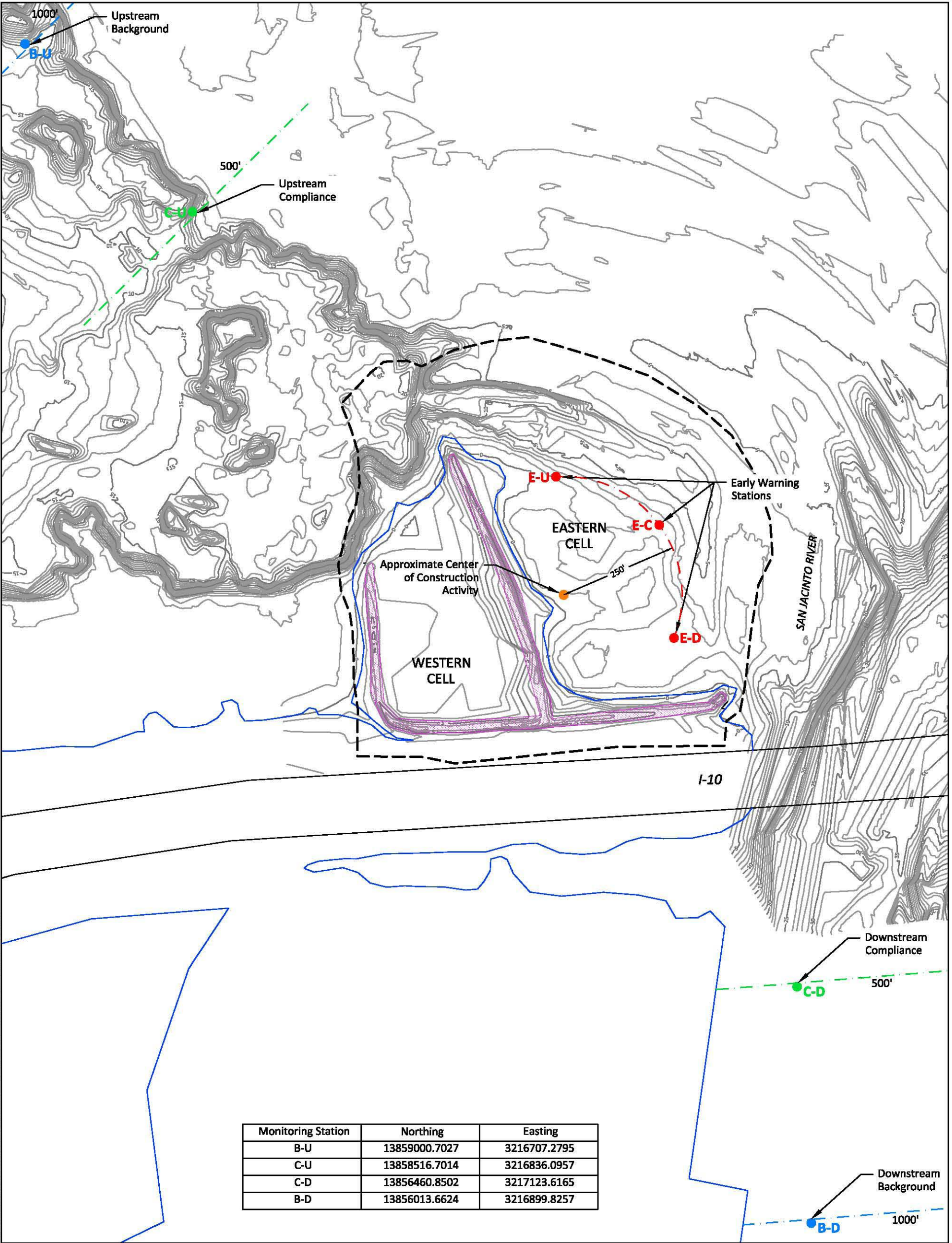


Figure 1-1
Vicinity Map
SJRWPAW

K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-047 DWG FIG 2-1
Aug 18, 2010 3:49pm ghowell



SOURCE: Drawing prepared from COE
HORIZONTAL DATUM: Texas South Central,
NAD83. US Survey Feet.
VERTICAL DATUM: NAVD 88.

Station Identification Scheme
L-R
L: Water Quality Monitoring Plan
E: 250 Foot Early Warning Station
C: 500 Foot Compliance Station
B: 1000 Foot Background Station

R: River Location
U: Upstream
C: Channel-Ward
D: Downstream

LEGEND:
● **E-C** Water Quality Monitoring Stations
--- Project Boundary

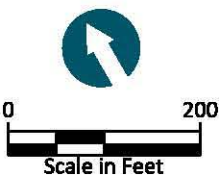


Figure 2-1
Water Quality Monitoring Stations
Time-Critical Removal Action Work Plan
San Jacinto River Waste Pits Superfund Site



ATTACHMENT D-1
WATER QUALITY MONITORING FORM

Water Quality Monitoring Form			
Station ID:		Date:	Time:
Project Name:		Project Number:	
Coordinates Datum:			
Lat/Northing:		Long/Easting:	
Weather/River Stage/Flow Observations:			
Status/Description of Operation at Time of Sampling:			
Depth to Bottom: _____ (m)			
	Turbidity (NTU)		
Depth 1: _____ (m)			
Depth 2: _____ (m)			
Depth 3: _____ (m)			
Other:			
Evidence of floating or suspended materials:			
Evidence of oil/hydrocarbon sheen: (Thickness, contiguous?, size, rate of dissipation)			
Discoloration and Turbidity:			
Velocity at stated depth:			
Color:			
Odor:			
Other Observations:			
Comments:			
Recorded by:		Other Monitoring Personnel:	

APPENDIX E

CONSTRUCTION QUALITY ASSURANCE PLAN

TIME CRITICAL REMOVAL ACTION

SAN JACINTO RIVER WASTE PITS

SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

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LIST OF ACRONYMS AND ABBREVIATIONS

10H:1V	10 horizontal to 1 vertical
AOC	Administrative Order on Consent
ARAR	applicable or relevant and appropriate requirement
BMPs	best management practices
CHASP	Contractor's Health and Safety Plan
CIH	Certified Industrial Hygienist
CQAO	Construction Quality Assurance Officer
CQAP	Construction Quality Assurance Plan
CQC	Construction Quality Control
EPP	Environmental Protection Plan
GPS	global positioning system
HAZWOPER	Hazardous Waste Operations and Emergency Response
IPC	International Paper Company
MIMC	McGinnes Industrial Maintenance Corporation
NAVD 88	North American Vertical Datum of 1988
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
RAWP	Removal Action Work Plan
RACR	Removal Action Completion Report
RTK	real-time kinematic
SAP	Sampling and Analysis Plan
Site	San Jacinto River Waste Pits Superfund Site
SOQ	statement of qualification
TCEQ	Texas Commission on Environmental Quality
TCRA	Time Critical Removal Action
UAO	Unilateral Administrative Order
USEPA	United States Environmental Protection Agency
WQMP	Water Quality Monitoring Plan

1 INTRODUCTION

This Construction Quality Assurance Plan (CQAP) is an appendix to the Removal Action Work Plan (RAWP) prepared for the United States Environmental Protection Agency (USEPA) for the Time Critical Removal Action (TCRA) at the San Jacinto River Waste Pits Superfund Site (Site). Requirements for the RAWP for the TCRA are described in the Administrative Order on Consent (AOC), Docket No. 06-03-10, entered into by McGinnes Industrial Maintenance Corporation (MIMC) and International Paper Company (IPC) (collectively, the Respondents) (USEPA 2010). This document addresses the requirement of the AOC to submit a Site-specific Quality Assurance Project Plan (QAPP) as part of the RAWP.

The purpose of this CQAP is to detail the approach to quality assurance and verification methods to be used during TCRA construction activities, including compliance with applicable or relevant and appropriate requirements (ARARs). To accomplish this purpose, this document identifies the responsibilities during TCRA construction activities and procedures for monitoring the performance of the TCRA construction activities in accordance with the final design documents through a quality assurance program. Additionally, this CQAP describes the methods used to measure compliance with performance objectives.

Because the collection of environmental samples is not anticipated during the TCRA, this CQAP does not address the collection of environmental samples for chemical analysis. Should environmental sampling be required, the collection, analysis, and reporting for environmental samples will be performed in accordance with the SAP/QAPP (Integral Consulting and Anchor QEA 2010) submitted to and approved by USEPA under the Unilateral Administrative Order (UAO), Docket No. 06-03-10, to MIMC and IPC on November 20, 2009 (USEPA 2009).

1.1 Additional RAWP Documents

As noted above, the CQAP is an appendix to the RAWP, which provides the details of the TCRA design. Other appendices to the RAWP provide additional details of the TCRA that are pertinent to and cited in the CQAP. These other documents include:

- TCRA Specifications (Appendix A to the RAWP)
- TCRA Plan Sheets (Appendix B to the RAWP)
- TCRA Water Quality Monitoring Plan (WQMP; Appendix D to the RAWP)
- TCRA Operations, Monitoring and Maintenance (presented in the body of the RAWP)

1.2 CQAP Organization

The remainder of this CQAP is organized into the following sections to address the document requirements detailed in the AOC (USEPA 2010):

- Section 2 – Project Organization and Responsibilities presents the roles and responsibilities of the parties involved in the TCRA, including USEPA and other agencies.
- Section 3 – Contractor and Construction Quality Assurance Officer (CQAO) Qualifications describes the qualifications and experience required for the Contractor and any selected subcontractors as well as the qualifications of the CQAO and supporting inspection personnel.
- Section 4 – Quality Assurance Program describes the performance objectives and criteria, quality assurance measures, inspection and verification activities, and contingency actions for each construction activity.
- Section 5 – Documentation and Reporting describes the reporting requirements for construction quality assurance activities. These requirements include daily and weekly summary reports, inspection data sheets, problem identification and corrective measures reports, design acceptance reports, and final documentation. A description of the provisions for final storage of all records consistent with the requirements of the AOC (USEPA 2010) is also included in this section.
- Section 6 – References presents the references cited and used to generate this document.

2 PROJECT ORGANIZATION AND RESPONSIBILITIES

The roles and responsibilities of the parties involved in the TCRA are delineated below. An organization chart depicting general project administration, management, and oversight is presented on Figure 1.

2.1 U.S. Environmental Protection Agency and Other Agencies

USEPA is the regulatory authority and is the responsible agency for overseeing and authorizing the TCRA described herein. In this capacity, USEPA will review information described in the RAWP, the Construction Specifications and Drawings, and this CQAP for consistency with the TCRA objectives, the AOC, and applicable state and federal laws and regulations. The USEPA Project Coordinator, or a designee, will exercise project oversight for USEPA, coordinate comments developed by USEPA and other agencies, and communicate agency observations with the Respondents and the Project Engineer. The USEPA Project Coordinator shall notify the Respondents if it identifies any concerns regarding the implementation of the TCRA. The Respondents will propose to USEPA and the USEPA Project Coordinator response measures or recommendations, as appropriate. The USEPA, as appropriate, will make final decisions to resolve such issues or problems that may change the project scope.

The USEPA is working cooperatively with other government agencies, including the Texas Commission on Environmental Quality (TCEQ), Harris County Public Health and Environmental Services, Harris County Flood Control District, and other federal and state agencies. These agencies will participate in TCRA review and coordination as determined by USEPA. When applicable, these agencies will provide their comments directly to the USEPA Project Coordinator for communication to the Respondents.

For security purposes and as a requirement of the TCRA, access to the Site is restricted by a fence. Agency representatives should contact the construction quality assurance officer (CQAO) to arrange for Site visits. The CQAO will coordinate Site access for visitors.

2.2 Respondents Project Manager

The construction project will be managed by the Respondents. The Respondents have ultimate responsibility for implementing the TCRA and addressing the requirements of the AOC. The Respondents, or their consultant, will be responsible for construction management and contract administration. The Respondents will hire the Contractor and, indirectly, its subcontractors specializing in the required in-water/over-water TCRA activities including transporting cap materials in a marine environment, shoreline stabilization, and Armored Cap placement. The Project Engineer and CQAO will also be contracted by the Respondents to fulfill the responsibilities identified in the following sections; the Respondents will review all work products prepared by its contractors and consultants and takes responsibility for the actions of its employees, contractors, and consultants. If any concerns arise regarding the implementation of the TCRA, the Respondents will communicate the concerns to the USEPA Project Coordinator, including any proposed remedies, if warranted, to address unforeseen conditions.

The Respondents Project Manager (Respondents PM) is responsible for implementing the TCRA in accordance with the AOC (USEPA 2010). The Respondents PM will implement the CQAP, review Contractor work products, and be the point of contact with USEPA.

2.3 Project Engineer

The Project Engineer is responsible for two main tasks. First, the Project Engineer is responsible for preparing the design of the TCRA such that successful implementation of the design will result in achieving the objectives of the AOC and construction activity-specific objectives.

Additionally, the Project Engineer will provide consultation and observations during construction to assist with implementation of the TCRA in conformance with the USEPA-approved design documents. During implementation of the TCRA, potentially noncompliant construction activities will be observed by or referred to the Project Engineer. The Project Engineer is responsible for determining whether the allegedly noncompliant construction is acceptable within the design, unacceptable, or acceptable with a design modification. USEPA will have final authority to approve design modifications proposed by the Project

Engineer. Design modifications proposed by the Contractor will be referred to the Project Engineer; the Contractor will not contact USEPA directly with proposed modifications.

2.4 Construction Quality Assurance Officer

The CQAO will be responsible for overseeing the implementation of the CQAP. In overseeing implementation of the CQAP, the CQAO is responsible for monitoring construction for compliance with construction performance standards and design requirements during implementation of the TCRA, and is responsible for overseeing the required inspection and verification activities. The CQAO will review documentation submitted by and work completed by the Contractor for adherence to performance standards and design requirements. The CQAO will be sufficiently familiar with the final design and the construction operations to recognize deviations from that design. The CQAO will also have the ability to manage and maintain the integrity of the data generated during the TCRA.

The CQAO will also be responsible for identifying those field conditions that may warrant deviation from the final design. In such circumstances, the CQAO will coordinate with the Respondents and USEPA Project Coordinator to identify and agree upon any necessary deviations to meet the overall objectives of the design. Any agreed-upon deviations will be documented in the weekly progress reports to USEPA.

The CQAO may use inspectors with the requisite expertise and experience to assist with performing the duties described above.

2.5 General Contractor

The Contractor will be responsible for implementing the TCRA by either performing construction tasks or contracting with and managing subcontractors. The Contractor is responsible to ensure that the work complies with contract final Construction Specification and Drawing requirements and provide all necessary quality control information.

As part of the TCRA implementation, the Contractor will be responsible for developing and implementing a Quality Management Plan (QMP). The QMP will include the required

monitoring, sampling, testing, and reporting needed to implement the project in accordance with the Construction Specifications and Drawings. Independent of the Contractor's quality control program, the Respondents will implement this CQAP to verify that the TCRA is implemented in accordance with the design. In accordance with implementing the TCRA construction activities, the Contractor will oversee the development of an Environmental Protection Plan (EPP).

The Contractor will use key personnel to help with the tasks described above, including a project manager, an on-site superintendent, a construction quality control manager, and a health and safety manager.

2.5.1 Contractor Project Manager

Direction of the work for the Contractor will be through a Project Manager who will be responsible for executing the work in full compliance with the Construction Specifications and Drawings. The Project Manager will be responsible for performing regular project reviews to monitor project performance versus the schedule and budget, reviewing and approving all project deliverables, and coordinating the resolution of technical issues that arise during the performance of the project.

2.5.2 Contractor On-site Superintendent

The Superintendent will perform day-to-day project management on-site and will supervise equipment and labor at the Site to ensure that Site personnel are executing the work in compliance with the Construction Specifications and Drawings. The Superintendent will be responsible for organization and control of on-site activities and work to resolve job-related problems. The Superintendent may utilize one or more foremen to directly supervise the major construction activities. The Superintendent will exercise supervision over subcontractors, if subcontractors are utilized.

2.5.3 Contractor Construction Quality Control Manager

A Construction Quality Control (CQC) Manager will be provided by the Contractor as required in the Construction Specifications. The CQC Manager will develop and implement a QMP through which the Contractor ensures compliance with the requirements of the

Construction Specifications and Drawings. The QMP will identify the duties and responsibilities assigned by the Contractor to the CQC Manager and additional inspectors, as needed, to monitor that the TCRA is implemented in accordance with the Construction Specifications and Drawings. The QMP will state the chain of command for the CQC team, including identification of responsibilities for each member, to ensure that any actions related to the quality of work will be executed in an accurate and expeditious manner. In addition, the CQC Manager will assist the Project Manager with submittal preparation and inspecting and receiving equipment and materials delivered to the Site.

2.5.4 Contractor Health and Safety Manager

The Contractor will employ a Health and Safety Manager to develop and implement the Contractor's Health and Safety Plan (CHASP). This plan will be site-specific and contain details of the chain of command and personnel responsibilities, as discussed in the Construction Specifications.

2.6 Subcontractors

The Contractor will either perform construction elements or contract with subcontractors to perform selected phases of the work for which the subcontractor has special expertise. The subcontractors are responsible to the Contractor for the quality of their work, protection of the environment, and adhering to the requirements of the Contractor's QMP, EPP, and CHASP. The subcontractor's principals will designate a job foreman with responsibility to see that the work is conducted in accordance with the Contractor's plans and the contract requirements.

3 QUALIFICATIONS

As required by the AOC, qualifications of the Project Coordinator and Contractor firm and personnel are provided below. Qualifications of the CQAO and supporting inspection personnel, including minimum training and experience required are also provided.

3.1 Project Coordinator

The Project Coordinator, acting on behalf of the Respondents, will have experience in managing environmental projects of a complexity and magnitude similar to or greater than the TCRA. The Project Coordinator will be responsible for administration of all actions by Respondents required by the AOC. The Project Coordinator will be thoroughly familiar with the AOC, applicable environmental laws, and the requirements of the TCRA. The Project Coordinator will be supported by additional personnel, such as an attorney and an engineer, assigned to the project.

3.2 CQAO and Inspector Qualifications

The CQAO will be determined prior to start of work. The CQAO will have an engineering degree and experience managing construction projects with similar quality assurance requirements. The CQAO will be required to have current Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) health and safety training. Additionally, the CQAO will be sufficiently familiar with the final design and the construction operations to recognize deviations from that design. The CQAO will also have the ability to manage and maintain the integrity of the data generated during the project. Additional inspectors may be used to assist the CQAO. These inspectors will have experience inspecting construction activities and will have current OSHA HAZWOPER health and safety training.

3.3 Contractor Qualifications

The Contractor will be selected through a competitive qualifications-based selection process. Each potential Contractor proposing on the project has provided a Statement of Qualifications (SOQ) to the Respondents prior to submitting a proposal. This has allowed the

Respondents to determine that the potential Contractor is qualified, in terms of experience and capability, to perform the work.

The Contractor will employ as part of its permanent organization, senior, knowledgeable, and experienced personnel to oversee the project. The journeyman operators, surveyors, and other Contractor personnel performing key jobs must also have the demonstrated ability and skills to satisfactorily perform their respective assignments.

The CQC Manager, and the Contractor as a whole, must have documented qualifications and experience to perform independent checks on the Contractor's operations as necessary to determine compliance with the contract provisions. These documented qualifications will be submitted to the Respondents for approval prior to identifying a CQC Manager.

Additionally, the Contractor must demonstrate to the satisfaction of the Respondents that any subcontractors utilized in the work are qualified and have satisfactorily performed the type of work for which they will be engaged. Responsibility for the subcontractor performance rests with the Contractor. All Contractor and subcontractor personnel working on this project will be required to have current OSHA HAZWOPER health and safety training, as applicable to the work they will be doing on this project.

4 QUALITY ASSURANCE PROGRAM

The quality assurance program to be implemented during the TCRA is described in this section. Specific construction activities to be implemented are described, along with specific performance objectives, performance criteria, quality assurance measures, inspection and verification activities, and contingency actions.

For each construction activity, inspection and verification activities will be implemented to confirm performance objectives have been met. Table 1 summarizes the required construction inspection and verification activities and frequencies of inspection for each construction activity.

During the TCRA, the quality assurance process will progress as follows:

- The Contractor will submit a QMP as detailed in Section 5. The QMP will be subject to approval by USEPA, the Respondents and Project Engineer before TCRA field work begins.
- The Contractor and the CQAO will conduct inspection and verification activities (i.e., sampling, testing, and monitoring) to ensure compliance with the approved design documents and to determine whether performance objectives have been met. The Respondents will have final approval authority for all such inspections and for verifying that corrective actions, if any are warranted, are implemented.
- The Contractor will provide documentation to the CQAO to demonstrate that specific components of the final design have been properly implemented. The Respondents, in consultation with the CQAO, will determine whether the components of the TCRA are acceptable.

The remainder of this section details the construction activities and associated performance objectives and criteria, along with quality assurance measures and specific inspection and verification activities that will be performed to confirm that performance objectives have been met.

4.1 Task Description

The following activities will be completed at the Site as part of the TCRA:

- Clearing and grubbing of vegetation on the western cell
- Upland surface grading of the western cell
- Geotextile placement over the eastern and western cells
- Armored Cap construction over the eastern and western cells, and northwestern area

The Armored Cap construction will be completed using well-graded crushed natural rock obtained from a quarry. Based on modeling of potential erosive forces at the Site, different rock gradations have been selected to complete the cap construction. The specifications and drawings present the gradational requirements and lateral extents of the different Armored Cap sections.

4.2 Performance Objectives and Criteria

Performance objectives and criteria associated with Armored Cap construction activities include the following:

- **Achieve Adequate Clearing and Grubbing.** The site must be properly cleared of vegetation before the Armored Caps can be constructed.
- **Achieve Site Grading to Design.** The site must be graded to the final grades presented on the Drawings. Contact to paper waste must be minimized.
- **Achieve Lateral Coverage of Geotextile.** The geotextile shall be placed to the lateral extents as shown on the Drawings.
- **Verify Quality of Import Material.** Import material must meet specified physical and chemical properties, as detailed in the Specifications, prior to the use of an imported material.
- **Achieve Specified Thickness and Extent.** The Armored Cap materials must be placed to the specified limits and thickness.
- **Avoid Impacts on Adjacent Slopes.** Placing Armored Cap materials in front of existing slopes should not lessen the overall stability of the slopes.

- **Minimize Release of Suspended Sediment.** The Armored Cap material must be placed in a controlled manner that will minimize the release of suspended sediment (i.e., limiting the energy of the material as it strikes the mud line to minimize re-suspension and mixing of contaminated material with the Armored Cap material). Water quality measurements will be used to monitor sediment resuspension.
- **Minimize Short-term Water Quality Impacts.** Water quality monitoring activities will be conducted to ensure federal and state water quality requirements are met. Water quality standards for capping activities are described in detail in the WQMP (Appendix D to the RAWP).

4.3 Quality Assurance Measures, Inspection and Verification Activities, and Contingency Actions

The quality assurance measures described below will be implemented during the TCRA to meet performance objectives and complete construction according to the Construction Specifications and Drawings. Inspection and verification activities will be implemented and the results of the inspection and verification activities will be compared to criteria to determine if performance objectives have been achieved. If performance standards have not been achieved, contingency actions as described below will be implemented.

4.3.1 Achieve Adequate Clearing and Grubbing

As part of this work item, the Contractor will cut at the ground surface and remove surface vegetation from the cap areas in preparation for future surface grading and/or cap placement. The Contractor will present a work plan before construction that will describe its proposed methods to complete the removal of vegetation, including a description of methods to be employed to decontaminate trucks for hauling vegetation, or methods such as temporary haul roads to be employed to prevent contact between the trucks and paper mill sludge. The Contractor shall also provide the name and location of the proposed facility for the disposal of removed vegetation.

Roots from vegetation 8 inches in diameter or smaller will be grubbed and evenly distributed across the western cell prior to geotextile placement. Roots from vegetation greater than 8 inches in diameter shall be cleared of adhering soil and properly disposed off-site. The

Contractor shall notify the CQAO when the Contractor has completed clearing and grubbing activities. The CQAO will visually inspect the cleared and grubbed area for the grubbing of roots from vegetation, and for the off-site removal of roots from vegetation greater than 8 inches in diameter. The CQAO will also inspect for even distribution of the grubbed vegetation remaining on-site; the intent of the inspection will be to avoid uneven pockets of vegetative mass prior to placement of the geotextile and cap.

4.3.2 *Achieve Site Grading to Design*

The Specifications require a number of quality control measures to control Site grading to minimize the potential for work not conforming to the surface elevations specified on the Drawings. These quality assurance measures include the following:

- Prior to commencing surface grading, the Contractor shall install an erosion control structure along the northwest portion of the western cell as shown on the Drawings. The intent is to primarily use perimeter levee material surrounding the western cell for fill material.
- If paper mill sludge is encountered during surface grading activities, the Contractor shall notify the Engineer immediately and provide recommendations for completing the surface grading activities while minimizing or eliminating the handling of the paper mill sludge.
- Cut material shall be placed and compacted as described in the specifications.

The Contractor will present a work plan before construction that will describe its proposed methods for controlling grades. The Contractor will also submit a survey control plan prior to construction. The CQAO will work closely with the Contractor's CQC Manager to independently verify the horizontal position and surface elevations of the graded areas. If the CQAO determines the Contractor is not grading and compacting the material to the correct surface elevations, the Contractor will immediately adjust work practices to correct the situation.

The Contractor will perform quality control topographic surveys during Site grading activities, as described in the Specifications. Accuracy for topographic surveys completed for upland work must be 0.01-foot accuracy. The final surface elevations for the graded area

must be within ± 0.25 foot of the elevations specified on the Drawings. The Contractor shall perform surveys at a minimum of every two working days to establish actual extent and elevations of the Site grading activities.

4.3.3 *Achieve Lateral Coverage of Filter Geotextile*

The Drawings and Specifications include quality control measures to control geotextile placement to minimize the potential for non conforming work. Quality assurance measures include the following:

- The geotextile will be anchored per manufacturer's recommendations on slopes to prevent creep of the geotextile down slope.
- Geotextile panels will overlap by a minimum of 3 feet.

The Contractor will perform a survey following geotextile placement activities to record the horizontal extent of geotextile placement. Accuracy for upland work shall be to the nearest ± 0.1 -foot for horizontal distance; accuracy of horizontal positions for in-water work shall be ± 3 feet at the 95 percent confidence interval.

The CQAO will visually inspect placed geotextile on the upland areas for complete lateral coverage. The CQAO will inspect a minimum of 10 percent of the panel seams for the minimum overlap distance of 3 feet. For geotextile placed below the water surface, the Contractor will develop quality assurance testing methods as part of the Contractor's work plan. Quality assurance testing for geotextile placed below the water surface may include probing, painting of geotextile seams combined and visual verification from a boat, visual inspection by a dive team, some combination of these or other methods.

4.3.4 *Verify Quality of Import Material*

All Armored Cap materials will be clean material free of roots, organic material, contaminants, and all other deleterious and objectionable material. The Contractor will submit a Borrow Source Characterization Report (geotechnical and chemical results) prior to delivery of each import material type to the Site. Chemical and physical characteristics of imported materials must meet the requirements detailed in the Specifications. The Contractor will sample imported material for grain size analysis and chemistry throughout

the project (three samples of each imported material type will be analyzed) for confirmation to Specifications. Note that large rock materials will not be able to be sampled for chemical analysis. The Contractor will obtain the certified tickets from the borrow source for each load of material delivered. Additionally, inspectors will visually inspect representative barge or truck loads of import materials delivered to the Site. Inspectors will observe unsuitable coatings or materials (e.g., debris and organics), as well as general conformity with the specified gradation. If necessary, the inspectors may obtain representative samples for physical testing to confirm compliance with the gradation requirements.

If import materials do not meet chemical criteria or physical requirements, material will be rejected prior to placement and the Contractor will be required to obtain a different material capable of meeting the Specifications.

If any Armored Cap material proposed by the Contractor requires on-site mixing of two or more imported materials, the Contractor shall be responsible for identifying and maintaining an on-site area for mixing and stockpiling of the imported materials. The Contractor shall mix the borrow materials to be thoroughly combined based on observation of uniform appearance and texture, and present the materials to the Project Engineer for inspection prior to placement.

4.3.5 *Achieve Specified Thickness and Extent*

The Specifications require a number of quality control measures to control Armored Cap construction, which will minimize the potential for work not conforming to the Drawings or Specifications. These quality assurance measures include the following:

- All Armored Cap materials on slopes must be placed from the toe of the slope up towards the crest.
- Armored Cap material will be placed in a manner to minimize disturbance and mixing of the Armored Cap material and sediment.
- A 6-inch over-placement tolerance will be allowed for Armored Cap materials placed below 2 feet NAVD 88 to facilitate achieving the required Armored Cap thickness.

The Contractor will present a work plan before construction that will describe its proposed methods for placing the Armored Cap layers and controlling grades. The Contractor will also submit a survey control plan prior to construction. The Contractor will be required to use real-time kinematic (RTK) global positioning system (GPS) for locating and tracking their equipment. The CQAO will work closely with the Contractor's CQC Manager to independently verify the horizontal position of Armored Cap placement equipment. If the CQAO determines the Contractor is not placing Armored Cap materials in the correct location, the Contractor will immediately stop work and correct the situation.

The Contractor will perform quality control topographic and hydrographic surveys during Armored Cap placement, as described in the Specifications. The control for this system must meet 0.25-foot vertical accuracy for in-water placement. Accuracy for topographic surveys completed for upland work must be 0.01-foot accuracy. These surveys will be performed at a minimum of every 2 working days to establish actual extent and thickness of Armored Cap placement.

Hydrographic surveys will be performed using a single-beam, dual-frequency or multi-beam, single-frequency echosounder system, or with a rod and staff if the water depth is too shallow for boat access. If a single-beam system is used, the trackline spacing will be no greater than 25 feet to minimize interpolation error.

The CQAO may advance cores or complete probing through the placed Armored Cap to visually confirm thickness if core sampling through the Armored Cap is technically feasible. Wherever the Armored Cap thickness based on bathymetry and/or cores is less than the specified amount, the Contractor will be required to add a sufficient amount of additional material to achieve the specified thickness.

4.3.6 Minimize Release of Suspended Sediment

The Specifications present a number of quality assurance measures to be implemented during Armored Cap placement activities to minimize the release of suspended sediment, such that the mixing of the contaminated surface material with the cover material is minimized. Measures to control suspension of sediment induced by Armored Cap placement include:

- A geotextile will be placed over the Eastern and Western Cells prior to placing imported fill materials for the Armored Cap.
- Armored Cap materials must be placed from the toe of the slope up towards the crest for slopes steeper than 10 horizontal to 1 vertical (10H:1V).
- Armored Cap material shall be placed in controlled lift thicknesses to minimize disturbance and mixing of the Armored Cap material and sediment.

The Contractor will present a work plan before construction that will describe its proposed methods for placing the Armored Cap, and for minimizing the release of suspended sediment. Water quality monitoring will be used to monitor sediment re-suspension as described in the WQMP (Appendix D to the RAWP).

4.3.7 Minimize Short-term Water Quality Impacts

Details of the water quality monitoring that will be completed, water quality action levels, and contingency actions that may be implemented if water quality action levels are exceeded during capping activities are provided in the WQMP (Appendix D to the RAWP).

5 DOCUMENTATION AND REPORTING

Documentation and reporting for construction quality assurance activities will include pre-construction documentation, construction documentation, and post-construction documentation as detailed below. The Contractor and the CQAO will work closely on a daily basis during the TCRA to complete the project as specified in the final design and to collect the documentation required. The following sections describe documentation that will be required throughout the TCRA. Table 2 summarizes the list of submittals that are required of the Contractor in the Construction Specifications (Appendix A to the RAWP).

5.1 Pre-construction Documentation

The Contractor will be required to submit a TCRA Work Plan for approval by the Respondents and USEPA. The TCRA Work Plan will contain the following elements:

- Project Work Plan
- QMP
- CHASP
- Construction EPP
- Project Construction Schedule
- Survey Control Plan
- Procedures for processing design changes and securing USEPA review and approval of such changes to ensure changes are consistent with the objectives of this TCRA

USEPA's approval authority for these plans is defined in the AOC (USEPA 2010).

Construction quality assurance and quality control procedures will be addressed in various elements of the TCRA Work Plan. A brief description of the contents of each plan component of the TCRA Work Plan is provided below.

5.1.1 Project Work Plan

The Project Work Plan will describe, in narrative form, the methods to be employed for the TCRA including equipment types, modes of operation, schedules, sequence of activities, and

other aspects necessary to describe how and when the specified work will be performed. The Project Work Plan will describe how each of the QA Measures and Verification Activities identified in Section 4 will be addressed in the field.

5.1.2 Contractor Quality Management Plan

The QMP will present the system through which the Contractor ensures that construction activities are being implemented in compliance with the requirements of the contract and specifically how each of the QA Measures and Verification Activities identified in Section 4 will be addressed in the field. The QMP will identify personnel, procedures, methods, instructions, inspections, records, and forms to be used in the CQC system. Specifically, the QMP will include a description of procedures for maintaining and updating daily activity logs, procedures for reporting out-of-spec conditions, recordkeeping procedures for personnel, equipment maintenance and calibration, and daily and weekly reporting requirements.

5.1.3 Construction Health and Safety Plan

The Contractor will submit its site-specific CHASP presenting the minimum health and safety requirements for job Site activities, and the measures and procedures to be employed for protection of on-site personnel. The Contractor will employ a Certified Industrial Hygienist (CIH) to produce this plan, whose proof of certification and resume will be submitted along with its CHASP. The plan will cover the controls, work practices, personal protective equipment (PPE), and other health and safety requirements that will be implemented by the Contractor in connection with the TCRA construction activities.

5.1.4 Construction Environmental Protection Plan

The Contractor will be required to submit an EPP describing the environmental protection measures and monitoring activities that will accompany all construction activities. The plan will cover potential environmental releases as a result of the Contractor operations, as well as monitoring and corrective actions necessary to control such releases. The EPP will contain separate sections addressing contamination prevention, containment and cleanup, erosion and turbidity control, sound level control, air pollution and dust control, and water quality monitoring as they pertain to the pertinent construction activities described in Section 4.

5.1.5 Project Construction Schedule

A detailed Project Construction Schedule will be submitted by the Contractor for each construction element prior to construction. Periodic schedule updates will be submitted by the Contractor following progress meetings.

5.1.6 Survey Control Plan

The Contractor will submit a Survey Control Plan prior to construction. The plan will detail the specific procedures, equipment, and personnel to be used for all upland and in-water surveying work. The plan will also discuss the quality assurance and quality control measures to confirm surveying results.

5.2 Construction Documentation

During construction activities, the Contractor will be required to provide a variety of documentation to the CQAO, including testing results of materials received, weight tickets for shipments of materials imported, survey results, and documentation of pay items completed. The Contractor will also maintain a daily log of activities, as described below. The CQAO will maintain a field report of daily activity and complete an internal weekly report. The contents of the reports are described below. Weekly progress reports will be completed by the CQAO in cooperation with the Contractor and submitted to USEPA. The records described in this section will be maintained in the project files. Monitoring data will be provided to USEPA in the Removal Action Completion Report (RACR).

All final construction documentation, including that described in Section 5.3, will be stamped, as appropriate, by licensed professionals. If, during the course of construction, modification of the final stamped and approved design is required, modifications will be documented in writing and stamped by a licensed engineer. Undocumented modifications of the design or other deviations from the approved design will not be permitted. Construction surveys, including as-built surveys, will be documented on drawings using the same datum, unit, and scale as design drawings. Record drawings will allow for a direct visual assessment of the quality and completeness of construction.

5.2.1 Contractor's Daily Quality Control Report

During construction activities, the Contractor shall prepare a Daily Quality Control Report and submit it to the CQAO. At a minimum, the Contractor's daily report will record the following:

- Identification of on-site personnel
- Activities completed
- Any changes to best management practices (BMPs) or environmental controls
- Materials delivered or used
- Equipment used
- Debris removed and disposed off-site
- Survey data
- Results of any quality control inspections, tests, or other monitoring activities
- Problems encountered or CQC deficiencies and resolution of problems
- Any USEPA-authorized deviations from the final design

Daily Quality Control Reports will be provided to USEPA on a weekly basis as part of the Weekly Summary Report as discussed below.

5.2.2 Construction Quality Assurance Officer's Daily Report

The CQAO will maintain a daily field log to record observations, measurements, inspections completed, data received, communications with other members of the project team or USEPA, any water quality exceedances, additional environmental controls that were implemented, problems encountered, and resolutions. The daily field log will be supported by submittals received from the Contractor, such as survey results and weight tickets, water quality monitoring results, laboratory data received, inspection reports, and written communication from members of the project team or USEPA. Water quality results will also be separately recorded and reported as defined in the WQMP (Appendix D of the RAWP).

5.2.3 Weekly Summary Reports

The CQAO, in cooperation with the Contractor, will prepare weekly summaries of progress. These summaries will facilitate the preparation of the RACR. The Weekly Summary Report will identify progress organized by activity:

- Armored Cap Placement
 - Area worked (supported by Contractor's log)
 - Weight/volume of material placed
 - Problems encountered
 - Corrective actions
- Environmental Controls
 - Samples collected
 - Summary of results
 - Problems encountered
 - Corrective actions

5.2.4 Weekly Construction Meetings

Weekly progress meetings will be coordinated with USEPA including pre-notification of time and place of meetings. Conference call access will be provided as needed and requested by USEPA, and meeting minutes will be prepared and made available to attendees.

5.2.5 Import Material Characterization

Prior to any on-site placement of import materials, the Contractor shall submit a Borrow Site Characterization Report to the CQAO. The characterization report will include identification of the source (including a map documenting the origin of the material), Site inspection, and material sample and characterization (physical and chemical testing, as specified) to ensure that the import material will uniformly meet the physical specifications of its intended use.

5.3 Post-Construction Documentation

As stated in the Statement of Work included with the AOC, the Respondents will submit a RACR to USEPA within 60 days after completion of the construction phase of the TCRA.

The RACR will contain the following information:

- Introduction
 - Site location
 - Environmental setting
 - Relevant operational history
 - Summary of previous investigations and actions
- TCRA Background
 - Basis for the TCRA (i.e., the AOC)
 - Removal action objectives
 - Summary of design basis
 - Summary of deviations from the design, if any
- Construction Activities
 - Description of mobilization and access road construction
 - Description of clearing and grubbing
 - Description of surface grading of the western cell
 - Description of geotextile placement
 - Description of importing and staging of Armored Cap materials
 - Description of Armored Cap placement
 - Description of completion and demobilization
- Chronology of Events
 - Description of the timing of construction activities, identifying milestones with reference to a tabular summary of a more detailed construction timeline
- Performance Standards and Construction Quality Control
 - Description of performance objectives (as stated in Section 4.2 of the CQAP) and verification activities performed to confirm the TCRA was implemented in accordance with the Specifications and Drawings.

- Description of actual construction performance relative to performance objectives, including a summary of the results of construction QA measurements and analyses
 - Description of contingency actions implemented, if any were necessary
 - Description of USEPA's oversight activities
 - Water quality monitoring results and associated QA
- Final Inspection and Certifications
 - Description of final inspections, including the scope of inspections and noting any deficiencies identified and corrective actions implemented
 - Summary of health and safety monitoring during the implementation of the TCRA with notation of deviations or incidents, if applicable
 - Identification of any institutional or engineering controls that are implemented to maintain the integrity of the TCRA, including identification of parties responsible for maintaining and enforcing controls
- Operation and Maintenance Activities
 - Description of post-construction monitoring and maintenance requirements
 - Description of contingency measures that would be implemented if post-construction monitoring indicates such measures are warranted
- Summary of Project Costs
 - Identification of the actual final costs incurred to comply with the provisions of the AOC
 - Identification of costs previously estimated for implementation of the TCRA and an update of the cost estimate for post-construction monitoring and maintenance costs
- Observations and Lessons Learned
 - Identification of problems encountered, if any, in implementing the TCRA and corrective actions implemented
 - Identification of successes in implementing the TCRA
 - Analysis of lessons learned that may be applied to future activities
- TCRA Contact Information

- Identification of individuals (contact names, addresses, phone numbers) for design and remediation contractors, USEPA oversight contractors, and key personnel for the Respondents, USEPA, and other agencies.

The RACR will also include copies of as-built drawings, summaries of waste disposal and analytical results (if applicable), water quality monitoring results, and the certification statement required by the AOC.

6 REFERENCES

- USEPA, 2009. Unilateral Administrative Order for Remedial Investigation/Feasibility Study. U.S. EPA Region 6 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Docket No. 06-03-10. In the matter of: San Jacinto River Waste Pits Superfund Site Pasadena, Texas. International Paper Company, Inc. & McGinnes Industrial Management Corporation, respondents.
- USEPA, 2010. Administrative Settlement Agreement and Order on Consent for Removal Action. U.S. EPA Region 6 CERCLA Docket No. 06-03-10. In the matter of: San Jacinto River Waste Pits Superfund Site Pasadena, Harris County, Texas. International Paper Company, Inc. & McGinnes Industrial Management Corporation, respondents.
- Integral Consulting and Anchor QEA. 2010. Sampling and Analysis Plan: Sediment Study. San Jacinto River Waste Pits Superfund Site. Prepared for McGinnes Industrial Maintenance Corporation and International Paper Company, and U.S. Environmental Protection Agency, Region 6. Integral Consulting, Seattle, WA and Anchor QEA, Ocean Springs, MS.

TABLES

Table 1
Construction Monitoring and Testing Requirements

Construction Element*	Monitoring, Testing, and Inspection Requirements	Monitoring Frequency
Construction Progress Documentation	Schedule monitoring	Daily
Safety and Health	Inspect site to determine protection requirements	Before mobilization
	Monitor work efforts for additional protection	After mobilization
	Assess integrity of all appropriate structures	Prior to work
	Site safety meetings	Daily
Temporary Erosion, Sediment, and Pollution Control	Inspect erosion control measures	Daily
	TESC measures during inactive work	Once every 14 days when inactive and within 24 hours after a storm with 0.5-inches precipitation per 24-hour period
Armored Cap Construction	Adequate clearing and grubbing	Prior to geotextile placement
	Observing paper waste during excavation	Throughout cutting and filling operations
	Proper lift thickness and compaction of cut material being placed as fill	Throughout cutting and filling operations
	Adequate geotextile coverage and seam overlaps	Prior to armor cap material placement
	Post-cover soundings	After cap placement is completed
	Daily survey	Every two days
	Borrow source inspection	Prior to importing material
	Physical and chemical testing of materials	3 samples for each type of imported material: once prior to importing material; and two other times spaced throughout project
	Visual inspection of import materials	Each load
	Monitor cover placement for vertical and lateral tolerances	Throughout cap placement
	Water quality and turbidity monitoring	Daily

* This table summarizes those Divisions of the Design Specifications that are most relevant to the CQAP.

Table 2
Contractor List of Submittals

Construction Element*	Submittal	Due Date
Pre-Construction Documentation	Construction Work Plan (CWP).** CWP shall include, at a minimum: <ul style="list-style-type: none"> project schedule proposed subcontractor(s) and their role(s) duties, responsibilities, and chain-of-command for onsite and offsite personnel procedures for identifying below-grade utilities in the work areas Borrow Source Characterization Report for each proposed Armored Cap material, including geotechnical and analytical results source(s) for geotextiles Quality Management Plan (QMP) describing Contractor's proposed methods and inspection procedures for the following work items, at a minimum: <ul style="list-style-type: none"> mobilizing equipment and materials to the Site installing Armored Cap over the Eastern Cell clearing and grubbing the Western Cell grading the Western Cell installing Armored Cap over the Western Cell installing Armored Cap over the Northwest Area decontamination procedures to eliminate the tracking of soils offsite demobilization procedures survey equipment, qualifications of survey crew, and proposed survey controls 	Within 7 calendar days of receiving the Limited Notice to Proceed
	Contractor Health and Safety Plan (CHASP)**	Within 7 calendar days of receiving the Limited Notice to Proceed
	Amendments to the CHASP	As appropriate
	Construction Quality Control (CQC) Plan**	Within 7 calendar days of receiving the Limited Notice to Proceed
	Site Security Plan (SSP)**	Within 7 calendar days of receiving the Limited Notice to Proceed
	Environmental Protection Plan (EPP)**	Within 7 calendar days of receiving the Limited Notice to Proceed
	Notification of Intent to Commence Work**	7 days prior to scheduled date to commence work

Table 2
Contractor List of Submittals

Construction Element*	Submittal	Due Date
Construction Progress Documentation	Daily CQC Reports, which shall include at a minimum: <ul style="list-style-type: none"> • equipment, materials, and labor present at the Site • activities completed • any changes to Best Management Practices (BMPs) or environmental controls • daily inspection and test reports • volume of material placed and the area affected • photocopies of weigh tickets for cover materials transported to the Site • certified test reports • survey data • results of quality control inspections, tests, or other monitoring activities • proposed procedures to address CQC deficiencies, if applicable • any USEPA-approved deviations from the final design 	Noon the following work day.
	Surveyed cross sections and volume of material placed for cover materials	Every two days as part of Daily CQC Report
	Borrow material test results during import	3 samples for each type of imported material, once prior to importing material, and two other times spaced throughout project
	Field Notes	Upon request
	Work Progress Schedule	
	Monthly Update Report	
	Application for Payment Summary	
	Progress Meeting Schedules	24-hour advance
	Contract Schedule Revisions	
Post-Construction Documentation	As-Built Drawings	Within 15 days of substantial completion.
	As-Built Schedule and Documentation	Within 15 days of substantial completion.
	Certificate of Completion	Within 15 days of substantial completion.
	Sealed survey of installed or replaced monuments and verification that survey was recorded in Harris County	Within 15 days of substantial completion.

* This table summarizes those Divisions of the Draft Design Specifications that are most relevant to the CQAP.

** These submittals constitute the TCRA Submittals required of the Contractor that will be approved by USEPA prior to the start of work.

FIGURES

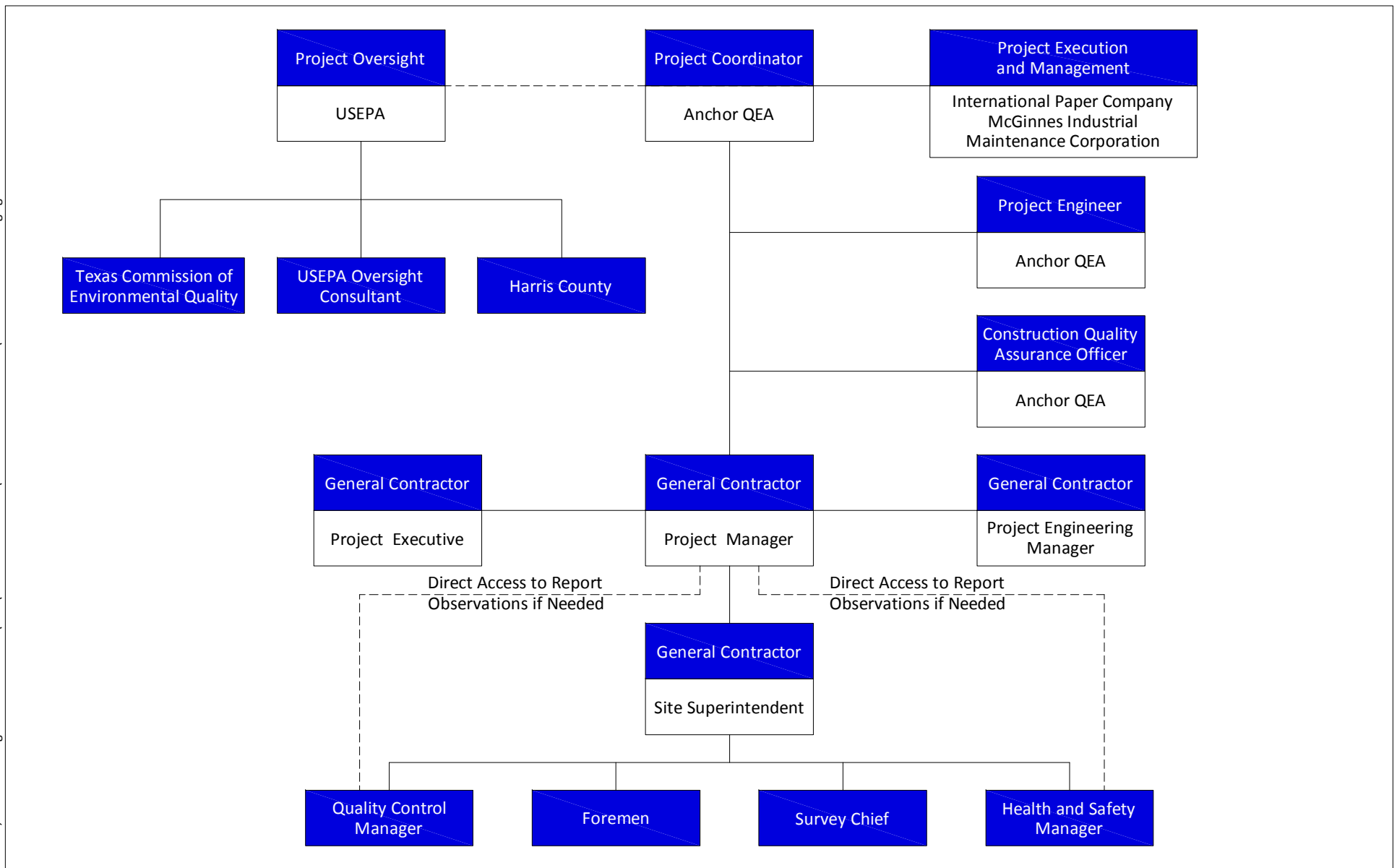


Figure 1
Organization Chart
SJRWP TCRA

APPENDIX F

HEALTH AND SAFETY PLAN/JOB SAFETY ANALYSIS FORMS

TIME CRITICAL REMOVAL ACTION

SAN JACINTO RIVER WASTE PITS

SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

HEALTH AND SAFETY PLAN

SAN JACINTO RIVER WASTE PITS

SUPERFUND SITE

Prepared for

McGinnes Industrial Maintenance Corporation

International Paper Company

U.S. Environmental Protection Agency, Region 6

Prepared by

Anchor QEA, LLC

2113 Government Street

Building D, Suite 3

Ocean Springs, MS 39564

December 2009

CERTIFICATION PAGE

David Keith, Ph.D., R.G., C.HG.
Project Manager
Anchor QEA, LLC

Jason Kase
Field Lead
Anchor QEA, LLC

Date: _____

Date: _____

The information in this Health and Safety Plan has been designed for the Scope of Work presently contemplated by Anchor QEA, LLC (Anchor QEA) for this Site; however, that scope of work is not yet fully understood. Therefore, this document may not be appropriate if the work is not performed by or using the methods presently contemplated by Anchor QEA. In addition, as the work is performed, conditions different from those anticipated may be encountered and this document may require modification. Therefore, Anchor QEA only intends this plan to address currently anticipated activities and conditions and makes no representations or warranties as to the adequacy of the Health and Safety Plan for all conditions encountered.

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT FORM

Project Number: 090557-01

Project Name: San Jacinto River Waste Pits

My signature below certifies that I have read and understand the policies and procedures specified in this Health and Safety Plan (HASP). For non-Anchor QEA employees, this HASP may include company-specific appendices to this plan developed by entities other than Anchor QEA.

Date	Name (print)	Signature	Company

Health and Safety Plan Acknowledgement Form

Date	Name (print)	Signature	Company

SITE EMERGENCY PROCEDURES

Emergency Contact Information

Table A
Site Emergency Form and Emergency Phone Numbers*

Category	Information	
Possible Chemicals of Concern	Dioxins/Furans	
Minimum Level of Protection	Level D	
Site(s) Location Address	(no formal address see Figure A) Channelview, TX 77530	
Emergency Phone Numbers		
Ambulance	911	
Fire	911	
Police	911	
Poison Control	911 and then 1-800-222-1212, if appropriate	
Client Contact - McGinnes Industrial Maintenance Corporation (MIMC)	Andrew Shafer	Office: (713) 647-5460 Cell: (832) 724-3802
Client Contract – International Paper (IP)	Phil Slowiak	Office: (901) 419-3845 Cell: (901) 214-9550
Project Manager (PM)	David Keith	Office: (228) 818-9626 Cell: (228) 224-2983
Field Lead (FL)	Jason Kase	Office: (850) 912-8400 Cell: (251) 259-7196
Corporate Health and Safety Manager (CHSM)**	David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279
National Response Center	1-800-424-8802	
State Emergency Response System	(512) 424-2138	
EPA Environmental Response Team	(201) 321-6600	

* In the event of any emergency contact the PM and FL.

** Integral Consulting Inc. (Integral) will be active on the site during some of the field activities anticipated for this project. The Corporate Health and Safety Manager (CHSM) for Integral is Eron Dodak; his phone numbers are: Office (503) 284-5545 x14; Cell (503) 407-2933. In event of an emergency involving Integral staff, Mr. Dodak must be contacted. Additional Integral contacts will be included in the addendums of this HASP that will be developed as part of task-specific Sampling and Analysis Plans (SAPs). Field personnel should refer to the HASP addenda that accompany the program-specific SAP for detailed emergency contacts.

Figure A
Site Location Map

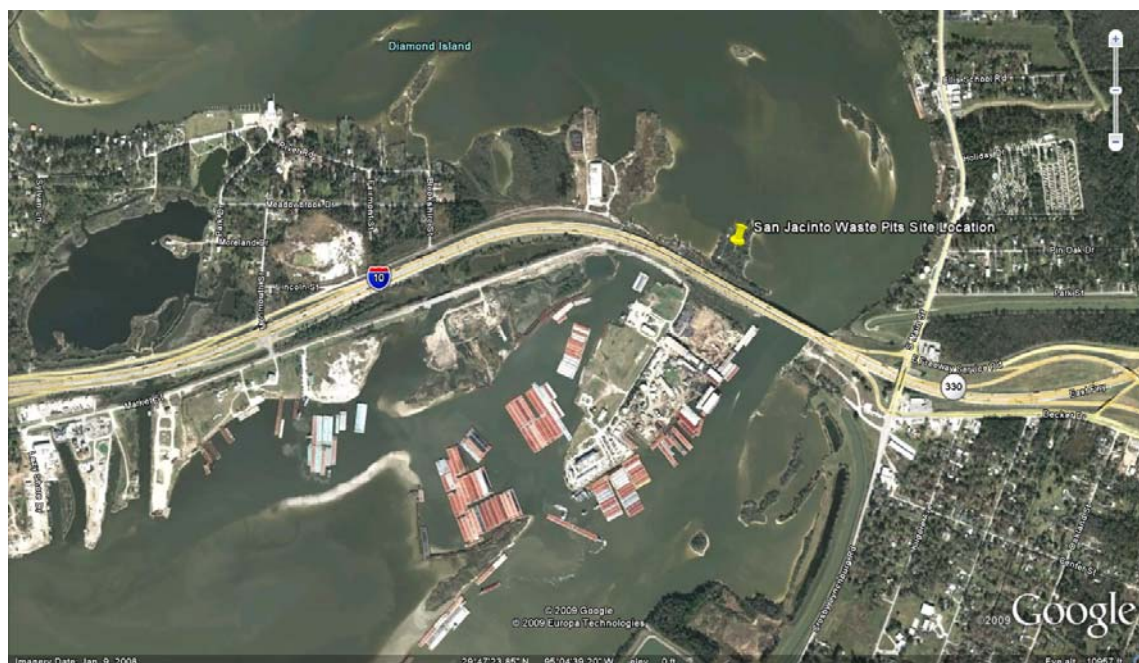
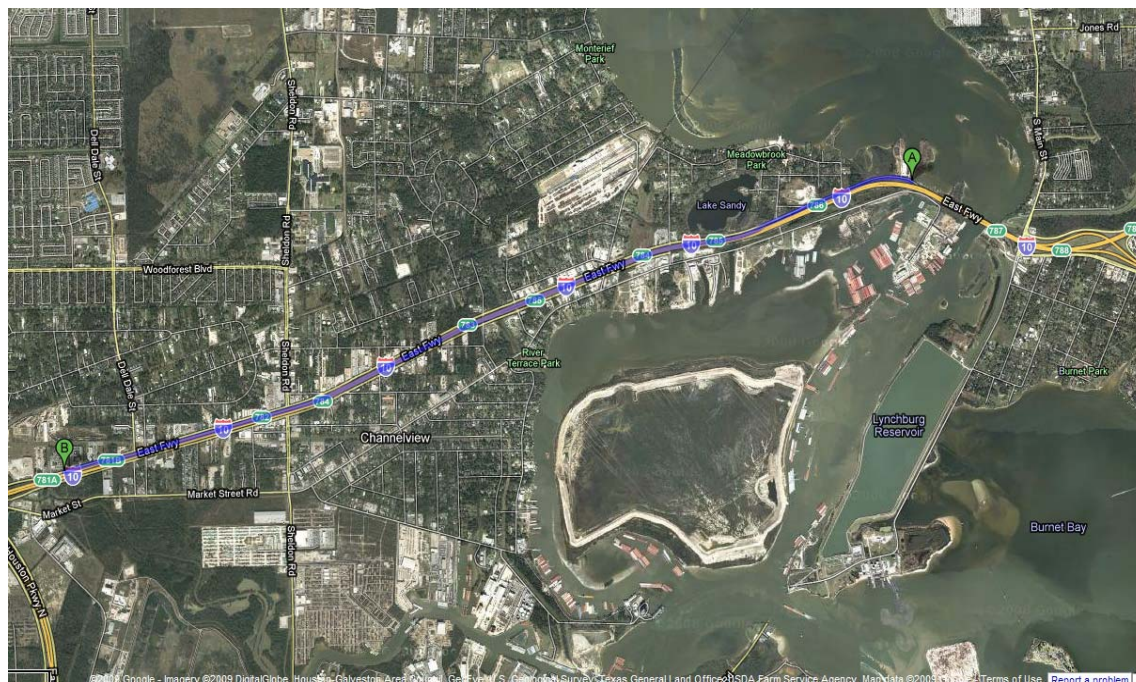


Table B
Hospital Information

Category	Information
Hospital Name	Triumph Hospital – East Houston
Address	15101 East Freeway
City, State	Channelview, TX 77530-41041
Phone	(713) 691-6556
Emergency Phone	(713) 691-6556

Figure B
Hospital Route Map



Hospital Route Map and Driving Directions

1. Head west on East Freeway Service Road toward Monmouth Street (approximately 0.9 miles)
2. Take the ramp on the left to I-10 West
3. Proceed on I-10 West to Exit 781B (approximately 3.7 miles)
4. Exit freeway at Exit 781B onto East Freeway Service Road
5. Continue heading west on East Freeway Service Road (approximately 0.2 miles)
6. Triumph Hospital will be on the right (total distance approximately 5 miles)

Figure C
Access to I-10 West

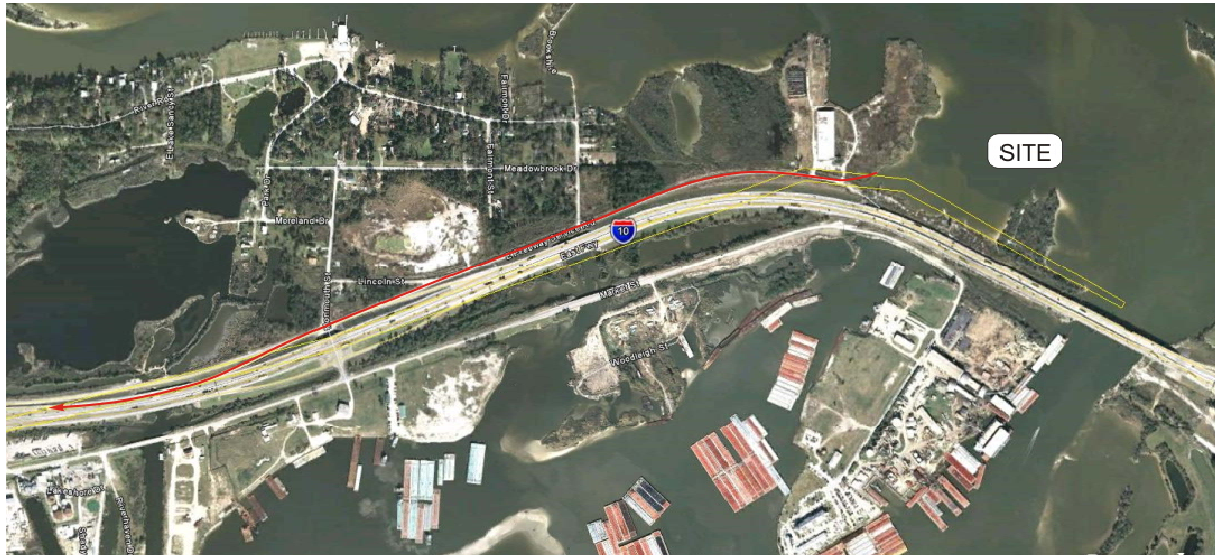


Figure D
Hospital Detail (Egress from I-10 West)



Key Safety Personnel

The following people share responsibility for health and safety at the site. See Section 4 of this HASP for a description of the role and responsibility of each.

Client Contact: Andrew Shafer (MIMC)	Office: (713) 647-5460 Cell: (832) 724-3802
Client Contact: Phil Slowiak (International Paper)	Office: (901) 419-3845 Cell: (901) 214-9550
Project Manager (PM): David Keith	Office: (228) 818-9626 Cell: (228) 224-2983
Field Lead (FL): Jason Kase	Office: (850) 912-8400 Cell: (251) 259-7196
Corporate Health and Safety Manager (CHSM): David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279

Emergency Response Procedures

In the event of an emergency, immediate action must be taken by the first person to recognize the event. Use the following steps as a guideline:

- Survey the situation to ensure that it is safe for you and the victim. Do not endanger your own life. Do not enter an area to rescue someone who has been overcome unless properly equipped and trained. Ensure that all protocols are followed. If applicable, review Material Safety Data Sheets (MSDS) to evaluate response actions for chemical exposures.
- Call the appropriate emergency number (911) or direct someone else to do this immediately (see Table A). Explain the physical injury, chemical exposure, fire, or release and location of the incident.
- Have someone retrieve the nearest first aid kit.
- If necessary, decontaminate the victim without delaying life-saving procedures (see Section 8).
- Administer first aid, and if necessary, cardiopulmonary resuscitation (CPR), if properly trained, until emergency responders arrive.
- Notify the Project Manager (PM) and the Field Lead (FL).

- Complete the appropriate incident investigation reports.

First Aid and CPR Guidelines

Personnel qualified and current in basic first aid and/or CPR procedures may perform those procedures as necessary. Personnel qualified and current in basic first aid and/or CPR are protected under Good Samaritan policies as long as they only perform the basic tasks that they were taught and if they have permission from a conscious victim. Do not perform first aid and/or CPR tasks if you have not been trained in first aid and/or CPR.

Injury Management/Incident Notification

Observe the following injury management/incident notification procedures and practices:

Injury Management

- Once a personal injury incident is discovered, the first action will be to ensure that the injured party receives appropriate medical attention.
- The nearest workers will immediately call 911 or the appropriate emergency number.
- If it is safe to approach the victim, ascertain the condition of the victim to communicate relevant information to the emergency response operator. If it is safe to do so, the nearest workers will immediately render first aid and assist a person who shows signs of medical distress or who is involved in an accident.
- Escort the injured person to the nearest hospital (see Figure B) or arrange for an ambulance.
- Proceed immediately to Notification Requirements, below.

Notification Requirements

- Directly after caring for an injured person, the FL will be summoned. The FL will immediately make contact with the PM or other designated individuals to alert them of the medical emergency. The FL will advise them of the following:
 - Location of the victim at the work site
 - Nature of the emergency
 - Whether the victim is conscious

- Specific conditions contributing to the injury, if known
- The PM will contact upper line management, including the Corporate Health and Safety Manager (CHSM), and the clients' contact persons.
- The CHSM will facilitate the incident investigation

All client requirements will also be adhered to that are pertinent to personal injury incident reporting.

Incident Other Than Personal Injury

All incidents including, but not limited to, fire, explosion, property damage, or environmental release will be responded to in accordance with the site-specific Health and Safety Plan. In general, this includes securing the site appropriate to the incident, turning control over to the emergency responders, or securing the site and summoning appropriate remedial personnel or equipment. Anchor QEA will immediately notify both of the clients of any major incident, fire, equipment or property damage, or environmental incident with a preliminary report. A full report will be provided to both of the clients within 72 hours.

Near-Miss Reporting

All near-miss incidents (those that could have reasonably lead to an injury, environmental release, or other incident) must also be reported to the FL and/or PM immediately so they can take action to ensure that such conditions that lead to the near-miss incident can be readily corrected to prevent future occurrences.

Spills and Releases of Hazardous Materials

When required, notify the National Response Center and the Texas Department of Public Safety, as appropriate. The following information should be provided to the National Response Center and the Texas Department of Public Safety:

- Name and telephone number
- Name and address of facility
- Time and type of incident
- Name and quantity of materials involved, if known

- Extent of injuries
- Possible hazards to human health or the environment outside of the facility

The emergency telephone number for the National Response Center is 1-800-424-8802. The emergency telephone number for the Texas Department of Public Safety is 512-424-2138.

If hazardous waste has been released or produced during the incident, ensure that:

- Waste is collected and contained
- Containers of waste are removed or isolated from the immediate site of the emergency
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided
- No waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed
- All emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

HASP Modification

This HASP will be modified by amendment, if necessary, to address changing field conditions or additional work tasks not already described in this document. Modifications will be proposed by the FL using the “Modifications to Health and Safety Plan” form included in Appendix A. Modifications will be reviewed and approved by the PM, in consultation with the CHSM.

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Appendix B	Material Safety Data Sheets (MSDS)
Appendix C	Job Safety Analysis (JSA) Documents

LIST OF ACRONYMS AND ABBREVIATIONS

° C	degrees Celsius
° F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
Anchor QEA	Anchor QEA, LLC
ANSI	American National Standards Institute
APR	Air-Purifying Respirator
CFR	Code of Federal Regulations
CHSM	Corporate Health and Safety Manager
COC	chemical of concern
CPR	Cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
dB	decibel
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
EZ	Exclusion Zone/Hot Zone
FID	Flame Ionization Detector
FL	Field Lead
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
HAZMAT	Hazardous Materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air
HMIS	Hazardous Material Information System
JSA	Job Safety Analysis
kPa	kilopascal
LEL	Lower Explosive Limit
LO/TO	Lockout/Tagout
mg/m ³	Milligrams per cubic meter
MHR	Maximum Heart Rate
MSDS	Material Safety Data Sheets

MIMC	McGinnes Industrial Maintenance Corporation
MUTCD	Manual of Uniform Traffic Control Devices
NEC	National Electrical Code
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priority List
O ₂	Oxygen
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Act or Administration
PAHs	Polycyclic Aromatic Hydrocarbon
P.E.	Professional Engineer
PEL	Permissible Exposure Limit
PFD	personal flotation device
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
ppm	parts per million
REL	Recommended Exposure Limits
RCRA	Resource Conservation and Recovery Act
STEL	Short Term Exposure Limit
SZ	Support Zone/Clean Zone
TLV	Threshold Limit Values
TSD	Treatment, Storage, and Disposal Facility
tsf	ton per square foot
TWA	Time Weighted Average
USCG	U.S. Coast Guard
VOC	Volatile Organic Compound
WBGT	Wet Bulb Globe Temperature

1 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared on behalf of MIMC and International Paper Corporation and presents health and safety requirements and procedures that will be followed by Anchor QEA, LLC (Anchor QEA) personnel and other contractors during work activities at the San Jacinto River Waste Pits Superfund Site (the Site). This HASP has been developed in accordance with Title 29 of the Code of Federal Regulations (CFR), Part 1910.120 (b), and will be used in conjunction with Anchor QEA's Corporate Health and Safety Program. This HASP will be modified by addendum if the scope of these activities is modified in a way that is not addressed by this HASP, or if there is a change to key personnel.

The provisions of this HASP are mandatory for all Anchor QEA personnel assigned to the project. Other contractors that will be working at the Site are also expected to follow the provisions of this HASP unless they have their own HASP that covers their specific activities related to this project. Any other contractor HASPs must include the requirements set forth in this HASP, at a minimum. All visitors to the work site must also abide by the requirements of this HASP and will attend a pre-work briefing where the contents of this HASP will be presented and discussed.

Personnel assigned to work at the Site will be required to read this plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of the HASP.

Other contractors are ultimately responsible for the health and safety of their employees. Other contractors may mandate health and safety protection measures for their employees beyond the minimum requirements specified in this HASP.

The objectives of this HASP are to identify potential physical, chemical, and biological hazards associated with field activities; establish safe working conditions and protective measures to control those hazards; define emergency procedures; and describe the responsibilities, training requirements, and medical monitoring requirements for site project personnel.

This HASP prescribes the procedures that must be followed during specific site activities. Significant operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Corporate Health and Safety Manager (CHSM).

Issuance of this approved plan documents that the workplace has been evaluated for hazards. A hazard assessment has been performed and the adequacy of the personal protective equipment (PPE) selected was evaluated as required by 29 CFR 1910.132(d) - Personal Protective Equipment, General Requirements (general industry), 1910.134 – Respiratory Protection, 1926.28 – Personal Protective Equipment (construction industry), and 1926.55 – Gases, vapors, fumes, dusts and mist, and is duly noted by the signature(s) and date appearing on the certification page of this document.

2 SITE DESCRIPTION/BACKGROUND INFORMATION

2.1 Site Description

The Site is located on the western bank of the San Jacinto River, immediately north of the Interstate Highway 10 (I-10) bridge. Areas to the west and south of the Site are industrial, while areas east and north of the Site are either undeveloped or residential. Residential development on the eastern bank of the river occurs within 0.5 miles of the Site. The *Screening Site Inspection Report* (SSI) Report prepared by the Texas Commission on Environmental Quality in 2006 states that the former waste pits were comprised of a series of three or more surface impoundments reportedly used to dispose of wastewater treatment sludge from the Champion Paper Mill in Pasadena, Texas; however, correspondence and drawings from the Texas State Department of Health indicate that there were only two impoundments at the Site.

Pulp and paper waste was transported by barge to the Site and unloaded into impoundments formed by levees in 1965/1966. The Site property boundary consisted of more than 20 acres, slightly less than 15 acres of which were utilized.

There were two impoundments at the Site connected with a drain line to allow flow of excess water (including rain water) from Impoundment #1 to Impoundment #2. The waste materials in the ponds were reported to have the following characteristics:

- Primarily fibrous – the dried material was reported to resemble a cheaper grade of cardboard
- Near neutral pH
- Medium stiff to stiff
- Low permeability
- Organic base – grass could be grown on the material.

In a letter dated July 1966, the Texas Water Pollution Control Board stated that it was their understanding that the waste ponds would not be used again for the storage of waste materials.

2.2 Site Background Information

Environmental investigations will be performed to support the design of expedited measures as well as to support the selection and design of a permanent remedy for the site. Previous investigations of sediment quality were reviewed for the preparation of this HASP.

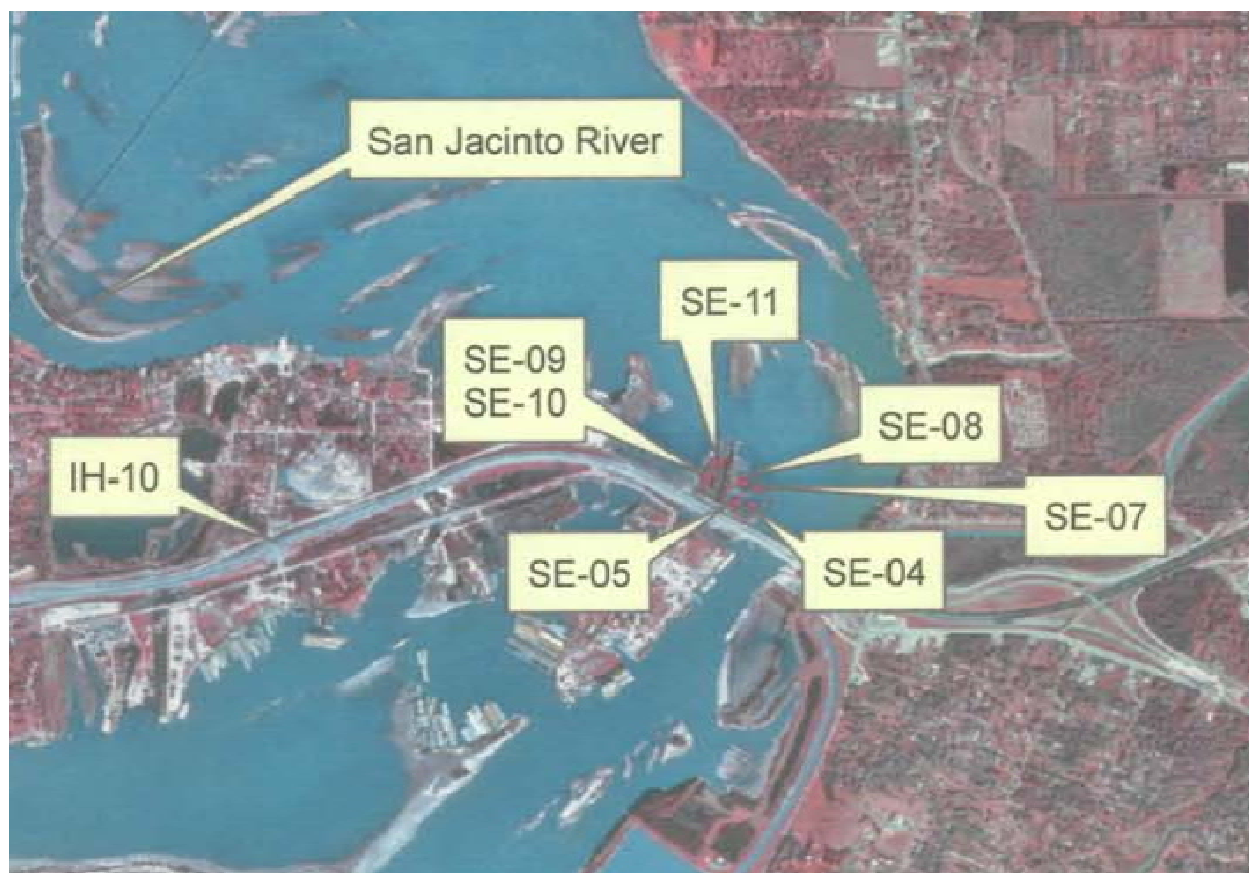
The SSI report reported the results of dioxin/furan and metals analyses of seven sediment samples collected near the site (locations SE-04, SE-05, and SE-07 through SE-11 on Figure 2 in the SSI report). The following table summarizes the maximum concentrations of dioxins/furans and metals reported in the SSI. Semivolatile organic compounds, pesticides, and polychlorinated biphenyls were not detected in the Site sludge materials. Volatile organic compounds were not analyzed for in the SSI.

Table 2-1
Concentration of COCs in Sediment

Constituent	Maximum Concentration
Dioxins/Furans (pg/g)	
2,3,7,8-Tetrachlorodibenzo-p-dioxin	33,900
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	363
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	4.83
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	27.9
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	10.2
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	658
2,3,7,8-Tetrachlorodibenzofuran	51,200
1,2,3,7,8-Pentachlorodibenzofuran	4,970
2,3,4,7,8-Pentachlorodibenzofuran	2,470
1,2,3,4,7,8-Hexachlorodibenzofuran	7,530
1,2,3,6,7,8-Hexachlorodibenzofuran	2,240
2,3,4,6,7,8-Hexachlorodibenzofuran	427
1,2,3,7,8,9-Hexachlorodibenzofuran	795
1,2,3,4,6,7,8-Heptachlorodibenzofuran	2,460
1,2,3,4,7,8,9-Heptachlorodibenzofuran	960
Metals (mg/kg)	
Aluminum	22,100
Barium	244
Chromium	19.7

Iron	14,900
Lead	48.0
Magnesium	4,790
Manganese	790
Mercury	1.7
Nickel	14.0
Vanadium	34.4
Zinc	244

Figure 2-1
Previous Sediment Sampling Locations



3 SCOPE OF WORK

3.1 Project Scope of Work

This plan addresses health and safety issues involved with the following field tasks:

- Sediment, soil, tissue, and surface water sampling to support the RI/FS
- Sampling to support the time-critical and nontime-critical removal action engineering design evaluations
- Oversight of site response construction activities

Tasks may be added to the project scope, and the details of the field tasks will be defined in the work plan documents that will be developed. Task-specific health and safety provisions, if not already covered by this HASP, will be developed and added to this HASP as addenda.

4 AUTHORITY AND RESPONSIBILITIES OF KEY PERSONNEL

This section describes the authority and responsibilities of key Anchor QEA project personnel. The names and contact information for the following key safety personnel are listed in the Emergency Site Procedures section at the beginning of this HASP. Should key site personnel change during the course of the project, a new list will be established and posted immediately at the site. The emergency phone number for the site is **911**, and should be used for all medical, fire, and police emergencies.

4.1 Project Manager

The PM provides overall direction for the project. The PM is responsible for ensuring that the project meets the client's objectives in a safe and timely manner. The PM is responsible for providing qualified staff for the project and adequate resources and budget for the health and safety staff to carry out their responsibilities during the field work. The PM will be in regular contact with the Field Lead (FL) and CHSM to ensure that appropriate health and safety procedures are implemented into each project task.

The PM has authority to direct response operations; the PM assumes total control over project activities but may assign responsibility for aspects of the project to others. In addition, the PM:

- Oversees the preparation and organization of background review of the project, the work plan, and the field team.
- Ensures that the team obtains permission for site access and coordinates activities with appropriate officials.
- Briefs the FL and field personnel on specific assignments.
- Together with the FL, sees that health and safety requirements are met.
- Consults with the CHSM regarding unsafe conditions, incidents, or changes in site conditions or the anticipated Scope of Work.

The PM will have completed the required Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER)

training and annual updates, the 8-hour Supervisor training, medical monitoring clearance (if necessary per requirements in Section 13).

4.2 Field Lead

The FL reports to the PM, has authority to direct response operations, and assumes control over on-site activities. The FL will direct field activities, coordinate the technical and health and safety components of the field program, and is responsible in general for enforcing this site-specific HASP and Corporate HASP requirements. The FL will be the primary point of contact for all field personnel and visitors and has direct responsibility for implementation and administration of this HASP. The FL and any other member of the field crew have the authority to stop or suspend work in the event of an emergency, if conditions arise that pose an unacceptable health and safety risk to the field crew or environment, or if conditions arise that warrant revision or amendment of this HASP. The following include, but are not necessarily limited to, the functions of the FL related to this HASP:

- Conduct and document daily safety meetings, or designate an alternate FL in his or her absence.
- Execute the work plan and schedule.
- Conduct periodic field health and safety inspections to ensure compliance with this HASP.
- Oversee implementation of safety procedures.
- Implement worker protection levels.
- Enforce site control measures to ensure that only authorized personnel are allowed on site.
- Notify, when necessary, local public emergency officials (all personnel on site may conduct this task as needed).
- Follow-up on incident reports to the PM.
- Periodically inspect protective clothing and equipment for adequacy and safety compliance.
- Ensure that protective clothing and equipment are properly stored and maintained.
- Perform or oversee air monitoring in accordance with this HASP.
- Maintain and oversee operation of monitoring equipment and interpretation of data from the monitoring equipment.

- Monitor workers for signs of stress, including heat stress, cold exposure, and fatigue.
- Require participants to use the “buddy” system.
- Provide (via implementation of this HASP) emergency procedures, evacuation routes, and telephone numbers of the local hospital, poison control center, fire department, and police department.
- Communicate incidents promptly to the PM.
- Maintain communication with the CHSM on site activities.
- If applicable, ensure that decontamination and disposal procedures are followed.
- Maintain the availability of required safety equipment.
- Advise appropriate health services and medical personnel of potential exposures.
- Notify emergency response personnel in the event of an emergency and coordinate emergency medical care.

The FL will record health-and-safety-related details of the project in the field logbook. At a minimum, each day’s entries must include the following information:

- Project name or location
- Names of all on-site personnel
- Level of PPE worn and any other specifics regarding PPE
- Weather conditions
- Type of field work being performed.

The FL will have completed the required OSHA 40-hour HAZWOPER training and annual updates, the 8-hour Supervisor training, medical monitoring clearance (if necessary per requirements in Section 13), and current first aid and cardiopulmonary resuscitation (CPR) training. Other certifications or training may be stipulated based on client or site requirements.

4.3 Corporate Health and Safety Manager

Anchor QEA’s CHSM will be responsible for managing on-site health and safety activities and will provide support to the PM and FL on health and safety issues. The specific duties of the CHSM are to:

- Provide technical input into the design and implementation of this HASP.

- Advise on the potential for occupational exposure to project hazards, along with appropriate methods and/or controls to eliminate site hazards.
- Ensure that a hazard assessment has been performed and that the adequacy of the PPE selected was evaluated as required by 29 CFR 1910.132(d), 1910.134, 1926.25, and 1926.55, and is duly noted by the signatures and date appearing on the Certification Page of this document.
- Consult with the FL on matters relating to suspending site activities in the event of an emergency.
- Verify that all on-site Anchor QEA personnel and other contractors have read and signed the HASP Acknowledgement Form.
- Verify that corrective actions resulting from deficiencies identified by audit and observations are implemented and effective.

The CHSM will have completed the required OSHA 40-hour HAZWOPER training and annual updates, the 8-hour Supervisor training, and have medical monitoring clearance (if necessary per requirements in Section 13). In addition, the CHSM will have current training in first aid and CPR.

4.4 Project Field Team

All project field team members will attend a project-specific meeting conducted by the FL concerning safety issues and project work task review before beginning work. All field crew, including other contractors, must be familiar with and comply with this HASP. The field crew has the responsibility to immediately report any potentially unsafe or hazardous conditions to the FL, and all members of the field crew have the authority to stop or suspend work if conditions arise that pose an unacceptable health and safety risk to the field crew or environment, or if conditions arise that warrant revision or amendment of this HASP. The field team reports to the FL for on-site activities and is responsible for:

- Reviewing and maintaining a working knowledge of this HASP
- Safe completion of on-site tasks required to fulfill the work plan
- Compliance with the HASP
- Attendance and participation in daily safety meetings
- Notification to the FL of existing or potential safety conditions at the site

- Reporting all incidents to the FL
- Demonstrating safety and health conscious conduct.

5 PROJECT-SPECIFIC REQUIREMENTS

This section provides activity-specific levels of protection and air monitoring requirements to be used on this site based on the anticipated Scope of Work and the chemicals of concern (COCs).

5.1 Activity-Specific Level of Protection Requirements

Refer to Section 10 of this plan for general requirements for PPE. Level D is the minimum acceptable level for most sites. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can come in contact with the skin or work uniform. An upgrade to Level C occurs when there is a potential for exposure to airborne COCs; i.e., if the results of air monitoring reveal that action levels have been exceeded. Hearing protection must be worn when there are high noise levels. Workers must maintain proficiency in the use and care of PPE that is to be worn.

Table 5-1, Project Job Tasks and Required PPE, describes the specific means of protection needed for each identified work activity.

5.2 Project Air Monitoring Requirements

Refer to Section 11 of this plan for general requirements for air monitoring at the project site, including information on air monitoring equipment. Previous investigations of the site indicate that the constituents of interest for worker health and safety during investigation and site response construction are dioxins and furans. There is no evidence of significant concentrations of volatile constituents in sediment or surface water. Therefore, respiratory protection is not expected to be needed and Modified Level D PPE should be appropriate for the entire investigation. Monitoring of the breathing zone will be performed during initial investigation activities, e.g., during collection of the first several sediment grab samples and cores. If air monitoring indicates the presence of unexpected concentrations of volatile organic compounds in the breathing zone, work will be suspended and the provisions of this HASP will be re-evaluated. Based on the results of the initial monitoring, the FL may decide to suspend further air monitoring if conditions warrant. Table 5-2, Project Air Monitoring Requirements, describes the specific air monitoring required for each identified work activity.

Table 5-1
Project Job Tasks and Required PPE

Job Tasks	PPE Requirements
EXAMPLES: <ul style="list-style-type: none"> Collecting sediment, soil, tissue and surface water grab samples Operation of sampling vessel and equipment Collection of sediment cores and processing sediment cores (visual inspection and subsampling) 	<input type="checkbox"/> Standard work uniform/coveralls
	<input type="checkbox"/> Work boots with safety toe
	<input checked="" type="checkbox"/> Traffic Safety Vest (when working in areas with vehicle traffic, heavy equipment)
	Chemical-resistant clothing <u>check appropriate garments</u> : <input type="checkbox"/> One-piece coverall <input type="checkbox"/> Hooded one- or two-piece chemical splash suit <input type="checkbox"/> Disposable chemical coveralls <input type="checkbox"/> Chemical-resistant hood and apron <input type="checkbox"/> Bib-style overalls and jacket with hood
	<input checked="" type="checkbox"/> Fabric Type: Tyvek NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with polycyclic aromatic hydrocarbons (PAHs) or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.
	<input checked="" type="checkbox"/> Disposable inner gloves (surgical) (required for all activities)
	<input type="checkbox"/> Disposable chemical-resistant outer gloves <input checked="" type="checkbox"/> Material Type: Nitrile (required for equipment decontamination and sediment core collection, not required for core processing)
	<input checked="" type="checkbox"/> Chemical-resistant boots with safety toe and steel shank or disposable boot covers for safety toe/work boots Material Type: Rubber or leather with disposable boot covers, if terrain and ground conditions allow use of boot covers without unreasonable danger of slipping hazard)
	<input type="checkbox"/> Sleeves to be duct-taped over gloves and pants to be duct-taped over boots
	<input type="checkbox"/> Splash-proof safety goggles
	<input checked="" type="checkbox"/> Safety glasses (face shield may be substituted for safety glasses if splash hazard is too great to be controlled with safety glasses)
	<input checked="" type="checkbox"/> Hard hat (if overhead or falling object hazards are present)
	<input type="checkbox"/> Hard hat with face shield
	<input checked="" type="checkbox"/> Hearing protectors (REQUIRED if site noise levels are greater than 85 decibels [dB] based on an 8-hour time-weighted average [TWA]). Type: Ear plugs
	<input type="checkbox"/> Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)

Job Tasks	PPE Requirements
	<input type="checkbox"/> Long cotton underwear
	<input checked="" type="checkbox"/> U.S. Coast Guard (USCG)-approved personal flotation device (PFD)
	<input type="checkbox"/> USCG-approved float coat and bib-overalls (e.g., full two-piece “Mustang” survival suit or similar) or one-piece survival suit if water temperatures are below 50° F
	<input type="checkbox"/> Half-face Air-Purifying Respirator (APR) (OSHA/NIOSH-approved)
	<input type="checkbox"/> Full-face APR (OSHA/NIOSH-approved)
	<input type="checkbox"/> Type of Cartridges to be Used: <input type="checkbox"/> OV or <input type="checkbox"/> OV/HEPA (if samples are dry)

Table 5-2
Project Air Monitoring Requirements

Instrument*	Job Tasks / Functions	Measurement	Monitoring Schedule	Actions¹
FID and/or PID - Measures Total Organic Vapors	Conduct air monitoring for volatile organic compounds (VOCs) initially during activities where VOC contaminated media may be present (during the collection of soil samples, sediment grab samples, and sediment cores). Make sure that a background reading is taken before the start of activities and periodically thereafter. The FL may discontinue air monitoring, in consultation with the PM, after reviewing monitoring results from initial sampling activities.	0 to 5 ppm above background in breathing zone	As soon as practical after collecting the grab sample or while pulling a sediment core sample onto the deck of the sampling vessel. The FL may suspend air monitoring based on data from the first several sampling locations.	Acceptable, continue work.
		> 5 ppm above background in breathing zone		Stop work required ² . Leave work area and contact Project Manager (PM) and Corporate Health and Safety Manager (CHSM) for guidance.

*Note: Instruments must be calibrated according to manufacturer's recommendations.

1 For VOCs, a sustained reading for greater than 2 minutes in excess of the action level will trigger a protective measure.

2 Contact with the CHSM and PM must be made prior to continuance of work. A hazard review must be conducted before proceeding with work. Corrective actions may include temporary work stoppage to allow vapors to dissipate, and then returning to work if air monitoring data permits.

ppm – parts per million

mg/m³ – milligrams per cubic meter

6 RISK ANALYSIS AND CONTROL

The following sections discuss the potential worker health and safety hazards associated with the potential field tasks associated with investigation activities that are anticipated for the Site. Controls of these hazards are addressed through the mechanical and physical control measures, use of PPE, monitoring, training, decontamination, emergency response, and safety procedures.

Significant changes in the anticipated Scope of Work covered by this HASP must be communicated to the PM and CHSM, and an amendment to this HASP must be created as needed. Any task conducted beyond those identified in the anticipated Scope of Work and this HASP must be evaluated using the Job Safety Analysis (JSA) process prior to conducting the work.

6.1 Job Safety Analysis

Work tasks will be evaluated for their hazards, and JSA documents will be developed that detail the chemical, physical, and biological hazards associated with these tasks, along with the control measures (e.g., engineering controls, administrative controls, and/or PPE) that will be used to ensure that these tasks are conducted in a safe manner.

The PM and FL are responsible for identifying work tasks and project site conditions that are beyond JSA documents and the HASP for communicating such information to the CHSM. The CHSM will provide support, as needed, to the PM and/or the FL, who will have primary responsibility to develop project-specific JSAs.

The contents of the JSA documents shall be communicated to project personnel during the site orientation meeting and during daily safety meetings when conducting work where the specific JSAs are applicable.

JSA documents applicable to this project will be located in Appendix C of the HASP as it is amended.

6.2 Exposure Routes

Possible routes of exposure to the chemicals potentially encountered on this project include inhalation, dermal contact, and ingestion of dust, mist, gas, vapor, or liquid. Exposure will be minimized by using safe work practices and by wearing the appropriate PPE. A further discussion of PPE requirements is presented in Section 10.

6.2.1 Dermal Contact

Dermal contact with potentially contaminated soil, sediment, biota, surface water, or groundwater during field activities is possible. Direct contact will be minimized through the use of appropriate PPE and decontamination procedures.

6.2.2 Ingestion

Direct ingestion of contaminants can occur by inhaling airborne dust, mist, or vapors, or by swallowing contaminants trapped in the upper respiratory tract. Indirect ingestion can occur by introducing the contaminants into the mouth by way of food, tobacco, fingers, or other carriers. Although ingestion of contaminants can occur, proper hygiene, decontamination, and contamination reduction procedures should reduce the probability of this route of exposure.

6.3 Chemicals of Concern Profile

The following table provides a summary profile for the COCs related to worker safety for this field project. As available, this profile is based on recent site history and site characterization information. For more detailed and specific information, always refer to the Material Safety Data Sheet (MSDS) or equivalent information for the chemical (see Appendix B).

Table 6-1
Chemicals of Concern Profile

Chemical	Physical/Chemical Characteristics (Target Organs/Route of Entry)	OEL (STEL)	Odor Threshold	LEL (%)	IP (eV)
Dioxins/Furans	Dermal contact, eye contact, ingestion, inhalation (dust)	N/A	N/A	N/A	N/A

Notes:

eV – electron volts

IP – Ionization Potential

LEL – Lower Explosive Limit

OEL – Occupational Exposure Limit (identifies the most restrictive exposure limit, e.g., federal or state OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV), and/or National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) for the chemicals of concern.

STEL – Short-term exposure limit

7 SITE CONTROL AND COMMUNICATIONS

The primary purposes for site controls are to establish the hazardous area perimeter, to reduce migration of contaminants into clean areas, and to prevent unauthorized access or exposure to hazardous materials by site personnel and the public. Site control is especially important in emergency situations.

7.1 General Site Control Safety Procedures

The following are standard safe work practices that apply to all Anchor QEA site personnel and other contractors and shall be discussed in the safety briefing prior to initiating work on the site:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited on site except in designated areas.
- Hands and faces should be washed upon leaving the work area and before eating, drinking, chewing gum or tobacco, and smoking.
- A buddy system will be used. Radio, cellular telephone, or hand signals will be established to maintain communication.
- During site operations, each worker will consider him/herself as a safety backup to his/her partner.
- Visual contact will be maintained between buddies on-site when performing hazardous duties.
- No personnel will be admitted to the site without the proper safety equipment, training, and medical surveillance certification.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, as established in this HASP, will be subject to corrective action, potentially including, but not limited to, reprimanded and immediate dismissal.
- Proper decontamination procedures must be followed before leaving a contaminated work area.

7.2 Work Area Access Control

If work is performed in public areas, the following precautions shall be taken to protect both the workers and the public. Access control to the work area will be accomplished by the use of a combination of the following devices and/or methods:

- Fences and/or barricades
- Traffic control devices and/or use of flaggers
- Caution tape
- Other methods to keep the site secure and provide a visual barrier to help keep unauthorized personnel from entering the site and active work areas.

7.3 Hazardous Waste Site Work Control Procedures

To prevent contamination from migrating from personnel and equipment, work areas will be clearly specified as an Exclusion Zone/Hot Zone (EZ), Contaminant Reduction Zone (CRZ), or Support Zone/Clean Zone (SZ) prior to beginning operations. Each work area will be clearly identified using signs or physical barriers. At the end of each workday, the site should be secured and/or guarded to prevent unauthorized entry.

Site work zones will include:

- **Exclusion Zone/Hot Zone (EZ).** The EZ will be the “hot zone” or contaminated area inside the site perimeter (or sample collection area of boat). The EZ is the defined area where potential respiratory and/or health hazards exist. All personnel entering the EZ must use the required PPE, as set forth in this HASP, and meet the appropriate training and medical clearance. Entry to and exit from this zone will be made through a designated point. Appropriate warning signs to identify the EZ should be posted (e.g., DANGER, AUTHORIZED PERSONNEL ONLY, PROTECTIVE EQUIPMENT REQUIRED BEYOND THIS POINT). Personnel and equipment decontamination must be performed upon exiting the EZ.
- **Contaminant Reduction Zone (CRZ).** The CRZ, also known as the “warm zone,” is a transitional zone between the EZ and the SZ (also known as the “cold zone” or “clean zone”). The CRZ provides a location for removal and decontamination of PPE and tools leaving the EZ. A separate decontamination area will be established for heavy

equipment. All personnel and equipment must exit via the CRZ. If, at anytime, the CRZ is compromised, a new CRZ will be established.

- **Support Zone/Clean Zone (SZ).** This uncontaminated zone will be the area outside the EZ and CRZ and within the geographic perimeters of the site (including boat and processing areas). The SZ is used for support personnel; staging materials; parking vehicles; office, laboratory, and sanitation facilities; and receiving deliveries.

Personnel entering this zone may include delivery personnel, visitors, security guards, and others who will not necessarily be permitted in the EZ or CRZ.

A log of all personnel visiting, entering, or working on the Site shall be maintained by the FL. No visitor will be allowed in the EZ without showing proof of training and medical certification, per 29 CFR 1910.120(e), (f). Visitors will attend a site orientation given by the FL and sign the HASP.

7.4 Site-Specific Work Zone Requirements

This section contains guidelines for maintaining safe conditions when sampling, including work performed on a boat.

7.4.1 Sampling Work Zones

Sampling and sample processing will occur within the EZ. The EZ will include, to the extent practical, a corridor between the boat access and the sample-processing area. Samples and contaminated equipment will be kept within the EZ until they are decontaminated and/or contained within coolers (samples) or other protective packaging (used equipment and investigation derived waste). Personnel and equipment leaving the EZ will exit through the CRZ, where contamination will be removed and disposable PPE will be discarded.

The vessel captain and the FL will delineate the boundaries of the work zones aboard the vessel and will inform the field crews of the arrangement. The purpose of the zones is to limit the migration of sample material out of the zones and to restrict access to active work areas.

Because space is limited on a sampling vessel, work zone designations are somewhat abbreviated and may need to be more flexible than when working on land. Two work zones will be observed aboard the vessel. Any area on a vessel where sampling activities are performed will be designated the EZ. Sediment cores and contaminated equipment will be stored in this work zone while they are transported to the upland sample processing area. Only the sampling crew may enter this zone unless assistance is required by other personnel. The second work zone will be for operating the vessel and storing clean equipment. To the extent practical, contaminated equipment and unprocessed samples, such as sediment cores, will be excluded from this relatively clean zone. Coolers of processed samples may be stored in this zone. Anchor QEA personnel will log and process the sediment cores on shore.

7.4.2 Access Control

Security and control of access to the sampling vessel and onshore area will be the responsibility of the captain and FL. Additional security measures may be placed into effect by the client, or as required by national security threat levels determined by the federal government. Access to the vessel and onshore areas will only be granted to necessary project personnel and authorized visitors. Any security or access control problems will be reported to the client or appropriate authorities.

7.4.2.1 Safety Equipment

In addition to PPE that will be worn by shipboard personnel, basic emergency and first aid equipment will also be provided. Equipment will include:

- U.S. Coast Guard (USCG)-approved personal flotation devices (PFDs)
- Emergency throw-ring (or similar)
- First aid kit adequate for the number of personnel
- Emergency eyewash.

Anchor QEA and/or other contractors working on Site will provide this equipment, which must be at the location(s) where field activities are being performed. Equipment will be checked daily to ensure its readiness for use.

7.5 Field Communications

Communications between all Anchor QEA employees and other contractors at the work site can be verbal and/or non-verbal. Verbal communication can be affected by the on-site background noise and various PPE. See Table 7-1 for a list of the types of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to ensure proper operation. All project personnel must be initially briefed on the communication methods prior to starting work; communication methods should be reviewed in daily safety meetings.

Table 7-1
Field Communication Methods

Type of Communication	Communication Device	Signal
Emergency notification	On-site Telephone or Cellular Telephone	Initiate phone call using applicable emergency numbers
Emergency notification among site personnel	Two-way Radio or Cellular Telephone	Initiate communication with Code Red message
Hailing site personnel for non-emergency	Compressed Air Horn	One long blast, one short blast
Hailing site personnel for emergency evacuation	Compressed Air Horn	Three long, continuous blasts
Hailing site personnel for distress, need help	Visual	Arms waved in circle overhead
Hailing site personnel for emergency evacuation	Visual	Arms waved in criss-cross over head
Contaminated air/strong odor	Visual	Hands clutching throat
Break, lunch, end of day	Visual	Two hands together, break apart

8 DECONTAMINATION PROCEDURES AND PRACTICES

8.1 Minimization of Contamination

The following measures will be observed to prevent or minimize exposure to potentially contaminated materials:

Personnel

- Do not walk through spilled materials
- Do not handle, touch, or smell sample media directly
- Make sure PPE has no cuts or tears prior to use
- Protect and cover any skin injuries
- Stay upwind of airborne dusts and vapors
- Do not eat, drink, chew gum or tobacco, or smoke in the work zones.

Sampling Equipment and Vehicles/Vessels

- Use care to avoid getting sampled media on the outside of sample containers
- If necessary, bag sample containers before filling with sampled media
- Place clean equipment on a plastic sheet to avoid direct contact with contaminated media
- Keep contaminated equipment and tools separate from clean equipment and tools
- Fill sample containers over a plastic tub to contain spillage
- Clean up spilled material immediately to avoid tracking around the vehicle/vessel

8.1.1 Decontamination Equipment

All vehicles, vessels, and equipment that have entered potentially contaminated areas will be visually inspected and, if necessary, decontaminated prior to leaving the area. If the level of vehicle contamination is low, decontamination may be limited to rinsing tires and wheel wells with an appropriate detergent and water. If the vehicle is significantly contaminated, steam cleaning or pressure washing may be required. Large tools will be cleaned in the same manner. Small reusable sampling equipment, including bowls, spoons, and knives, will be rinsed, washed in phosphate-free detergent, and rinsed again. Rinsate from all

decontamination activities will be collected for proper disposal. Decontamination of equipment and tools will take place within the CRZ.

The following supplies will be available to perform decontamination activities:

- Wash and rinse buckets
- Tap water and phosphate-free detergent (i.e., Alconox)
- Scrub brushes
- Distilled/deionized water
- Deck pump with pressurized freshwater hose (aboard the vessel)
- Pressure washer/steam cleaner, if appropriate
- Paper towels and plastic garbage bags.

8.1.2 Personnel Decontamination

The FL will ensure that all site personnel are familiar with personnel decontamination procedures as listed below. All personnel wearing PPE in a work area (EZ) must undergo decontamination prior to entering the SZ. Personnel will perform the following decontamination procedures:

- Wash and rinse outer gloves and boots in portable buckets to remove gross contamination. The surface of the site is contaminated with waste materials that will stick to boots. Disposable boot covers will be used if terrain and ground conditions are such that the use of disposable boot covers does not present a slipping hazard. If disposable boot covers are not used, particular attention must be applied to decontaminating boots thoroughly.
- If suit is heavily soiled, rinse it off. If disposable boot covers are used, they will be removed at this station.
- Remove outer gloves; inspect and discard if damaged. Leave inner gloves on. Personnel will remove their outer garment and gloves, dispose of them, and properly label container or drum. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items then will be hand-carried to the next station. Remove protective suit and then inner gloves.
- Thoroughly wash hands and face before leaving CRZ.

8.1.3 *Sampling and Processing Equipment Decontamination*

To prevent sample cross-contamination, sampling, and processing equipment in contact with soil, sediment, biota, or water samples will undergo the following decontamination procedures when work is completed in the CRZ and prior to additional use:

1. Rinse with potable water and wash with scrub brush.
2. Scrub with phosphate-free detergent (Alconox®).
3. Visually inspect the sampler and repeat the scrub and rinse step, if necessary. If scrubbing and rinsing with Alconox® is insufficient to remove visually observable contamination on equipment, the equipment will be scrubbed and rinsed using hexane (or similar type solution) until all visual signs of contamination are absent.
4. Rinse external sampling equipment with potable water three times prior to use. Rinse homogenizing equipment once with potable water and three times with distilled water prior to and between sample processing.

8.1.4 *Handling of Investigation-Derived Waste*

All remaining soil or sediment, fluids used for decontamination of sampling equipment, and sample collection disposable wastes (e.g., gloves, paper towels, foil, or others) will be placed into appropriate containers and staged on site for disposal.

8.1.4.1 *Disposable PPE*

Disposable PPE may include Tyvek suits, inner latex gloves, outer gloves, and disposable boot covers. Dispose of PPE according to the requirements of the client and state and federal agencies.

8.1.4.2 *Non-disposable PPE*

Non-disposable PPE includes items such as boots.

When decontaminating non-disposable PPE, observe the following practices and procedures:

- Decontaminate the PPE outside with a solution of detergent and water; rinse with water prior to leaving the site.

- Protect the PPE from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

8.1.5 *Sanitizing of Personal Protective Equipment*

Reusable protective clothing and other personal articles must not only be decontaminated before being reused, but also sanitized. The insides of face shields and protective clothing become soiled due to exhalation, body oils, and perspiration. If practical, reusable protective clothing should be machine-washed after a thorough decontamination; otherwise, it must be cleaned by hand.

8.1.6 *Emergency Personnel Decontamination*

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

8.1.7 *Containment of Decontamination Fluids*

As necessary, spill control measures will be used to contain contaminated runoff that may enter into clean areas. Use plastic sheeting, hay bales, or install a spill control system to prevent spills and contain contaminated water.

8.1.8 *Pressure Washing*

The following procedure is required when using high-pressure washing equipment for decontamination purposes:

- Wear modified Level D protection, including a face shield and safety goggles.
- Ensure that other personnel are out of the area prior to decontamination.
- Secure the area around the decontamination pad with cones, caution tape, or barricades.

- Ensure that safe work practices and precautions are taken to minimize the potential for physical injury from high-pressure water spray. Follow the manufacturer's operating instructions.
- The pressure washer wand must be equipped with a safety release handle.
- Ensure that the area is clean after equipment is decontaminated. Barricades, cones, or caution tape must be left in place and secured at all times.

9 HEALTH AND SAFETY TRAINING AND INFORMATIONAL PROGRAMS

This section describes the health and safety training and informational programs that Anchor QEA project site personnel must comply with.

9.1 Initial Project Site Orientation

Work on all Anchor QEA project sites will require participation in an initial health and safety orientation presented by the PM or FL that will consist of, at a minimum, the following topics:

- A review of the contents of this HASP, including the anticipated Scope of Work and associated site hazards and control methods and procedures.
- Provisions of this plan are mandatory for all Anchor QEA personnel assigned to the project.
- Other contractors working at the Site are also expected to follow the provisions of this plan unless they have their own HASP that covers their specific activities related to this project and includes the minimum requirements of this HASP.
- All visitors to the work site will also be required to abide by the requirements of this plan.
- Personnel assigned to perform work at the project site, working under the provisions of this HASP, will be required to read the plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of this plan.

9.2 Daily Safety Meetings

Daily safety meetings (“tailgate meetings”) make accident prevention a top priority for everyone and reinforce awareness of important accident-prevention techniques. The following daily safety meeting procedures and practices are required:

- Daily safety meetings will be held each morning prior to conducting site activities.
- The daily safety meeting form in Appendix A will be used to document each meeting.
- Copies of the completed daily safety meeting forms will be maintained on-site during the course of the project.

9.3 Hazardous Waste Operations Training

All personnel working on the Site shall be trained in accordance with the requirements of the 29 CFR 1910.120 (HAZWOPER) regulation. Training requirements will consist of the following:

- Field personnel must complete a minimum of 40 hours of hazardous waste activity instruction.
- Field personnel must complete a minimum of 3 days of supervised field instruction.
- Field personnel assigned to the site will also have received 8 hours of refresher training if time elapsed since their previous training has exceeded 1 year (i.e., refresher training is required annually).
- The PM and FL, or other staff directly responsible for employees engaged in hazardous waste operations, will receive an additional 8 hours of supervisory training.
- At a minimum, two people per field team shall be current in first aid/CPR and bloodborne pathogen training.

9.4 Hazard Communication Program

The purpose of hazard communication (Employee Right-to-Know) is to ensure that the hazards of all chemicals located at the field project site are communicated to all Anchor QEA personnel and other contractors according to 29 CFR 1926.59.

Every container of hazardous materials must be labeled by the manufacturer, who must also provide a MSDS upon initial order of the product and upon request thereafter. The actual format may differ from company to company (e.g., National Fire Protection Association [NFPA], Hazardous Material Information System [HMIS], or other), but the labels must contain similar types of information. Maintain manufacturer labels if at all possible. The label may use words or symbols to communicate the following:

- The name of the chemical
- The name, address, and emergency telephone number of the company that made or imported the chemical
- The physical hazards (Will it explode or catch fire? Is it reactive? Is it radioactive?)
- Any important storage or handling instruction

- The health hazards (Is it toxic? Could it cause cancer? Is it an irritant? What is the target organ?)
- The basic protective clothing, equipment, and procedures that are recommended when working with the chemical

MSDS for all chemicals brought onto the site or anticipated to be encountered on site shall be provided in Appendix B of this HASP. These MSDS shall be readily available for reference by site personnel and emergency response personnel.

Hazardous materials received without proper labels shall be set aside and not distributed for use until properly labeled.

If a hazardous chemical is transferred into a portable container (approved safety can), even if it is for immediate use only, the contents of the portable container (for example, acetone, gasoline, etc.) must be identified.

10 GENERAL PPE REQUIREMENTS

The minimum level of PPE should be selected according to the hazards that may be encountered during site activities in accordance with established U.S. Environmental Protection Agency (EPA) levels of protection (D and Modified D). Only PPE that meets American National Standards Institute (ANSI) standards shall be worn. Workers must maintain proficiency in the use and care of PPE.

Refer to Section 5 of this plan for site-specific job task and level-of-protection requirements.

10.1 Minimum Requirements – Level D Protection

The minimum level of protection on project sites will be Level D protection, which consists of the following equipment:

- Standard work uniform/coveralls
- Work boots with safety toe (meets ANSI Z41 – 1991 requirements for foot protection)
- Approved safety glasses or goggles (meets ANSI Z87.1 – 1989 requirements for eye protection)
- Hard hat if overhead or falling object hazards are present (meets ANSI Z89.1 – 1986 requirements for head protection)
- Traffic safety vest if working near heavy equipment or vehicular traffic
- Hearing protection when there are high noise levels

Level D protection will be used only when:

- The atmosphere contains no known hazards
- Work functions preclude splashes, immersions, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of chemicals
- Atmospheric concentrations of contaminants are less than the Permissible Exposure Limit (PEL) and/or Threshold Limit Value (TLV)

Level D protection, without modification, may be appropriate for observation of construction activities where soils do not need to be handled and where work activities do not require

walking across contaminated materials. Level D would also be appropriate for handling sample coolers or other containers where contaminated materials are fully contained.

10.1.1 Modified Level D Protection Requirements

Level D protection shall be modified, as warranted by site conditions and tasks performed, to include additional protective equipment such as USCG-approved PFDs, face shields/goggles, chemical-resistant clothing, rain gear, and disposable gloves of varying materials depending on the chemical substances involved. Modified Level D protection is the baseline gear for many of the sampling activities described in this HASP.

10.2 Respiratory Protection Requirements

Respiratory protection devices may potentially be used for protection against particulates and organic vapors during the course of an Anchor QEA field project. The need for respiratory protection will be determined by air monitoring results and site conditions. However, engineering and administrative controls must first be evaluated for use as the primary controls for protection against site respiratory hazards. In the event that engineering and administrative controls are deemed not feasible, respiratory protection will be required. As stated previously in this HASP, the use of respiratory protection is not anticipated. If significant concentrations of organic vapors are encountered, as discussed in Section 5, work will be suspended and this HASP will be modified, if necessary, to incorporate respiratory protection requirements.

11 GENERAL AIR MONITORING REQUIREMENTS

11.1 General Requirements

As discussed in Section 5, air monitoring will be performed during initial sample collection activities as a precaution; although the results of previous investigations indicate that respiratory protection will not be required. Site-specific air monitoring action levels are provided in Section 5.2 of this HASP.

11.2 Real-Time Air Monitoring Equipment

As applicable, organic vapor concentrations shall be monitored in the field with either a photoionization detector (PID) or flame ionization detector (FID). Flammable vapors and/or gasses are monitored with an oxygen/lower-explosive level (O₂/LEL) real-time instrument. Organic vapor measurements are usually taken in the breathing zone of the worker while O₂/LEL measurements are taken at the point of operation (e.g., monitoring well head or auger point).

As applicable, airborne dust/particulate concentrations shall be measured using a real-time aerosol monitor (using a scattered light photometric sensing cell) when there are visible signs of potentially contaminated airborne dust. Both area and personal air monitoring readings are to be taken to characterize site activities.

Air monitoring results shall be documented on the Daily Air Monitoring Record Form (see Appendix A) or in the field logbook.

11.3 Equipment Calibration and Maintenance

Calibration and maintenance of air monitoring equipment shall follow manufacturer specifications and must be documented. Recalibration and adjustment of air monitoring equipment shall be completed as site conditions and equipment operation warrant. Record all air monitoring equipment calibration and adjustment information on a Daily Air Monitoring Record form and in the field logbook.

11.4 Air Monitoring Action Levels

Air monitoring action levels have been developed that stipulate the chemical concentrations in the breathing zone that require an upgrade in level of PPE.

Air monitoring action levels are typically set at one-half of the OSHA PEL, NIOSH Recommended Exposure Limit (REL), or the American Conference of Governmental Industrial Hygienists (ACGIH) TLVs. The rationale for establishing action levels is based on the available data that characterize COCs in site media.

Air monitoring measurements shall generally be taken in the breathing zone of the worker most likely to have the highest exposure. Transient peaks will not automatically trigger action. Action will be taken when levels are consistently exceeded in a 5-minute period. Similarly, if chemical odors are detected that are a nuisance, bothersome, or irritating, an upgrade in respiratory protection can provide an extra level of comfort or protection when conducting site activities.

12 HEALTH AND SAFETY PROCEDURES AND PRACTICES

In addition to the task-specific JSAs presented in Appendix C of this HASP, this section lists the health and safety procedures and practices applicable to this project. For additional information, consult with the PM.

12.1 Physical Hazards and Controls

12.1.1 General Site Activities

Observe the following general procedures and practices to prevent physical hazards:

- Legible and understandable precautionary labels shall be affixed prominently to containers of potentially contaminated soil, sediment, water, and clothing.
- No food or beverages shall be present or consumed in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- No tobacco products or cosmetics shall be present or used in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- An emergency eyewash unit shall be located immediately adjacent to employees who handle hazardous or corrosive materials, including decontamination fluids. All operations involving the potential for eye injury or splash must have approved field eyewash units locally available.
- On a project-specific basis, personnel working on or near bodies of water shall wear USCG-approved PFDs.
- Generally, all on-site activities will be conducted during daylight hours. If work after dusk is planned or becomes necessary due to an emergency, adequate lighting must be provided.
- Hazardous work, such as handling hazardous materials and heavy loads and equipment operation, should not be conducted during severe storms.
- All temporary electrical power must have a ground fault circuit interrupter (GFCI) as part of its circuit if the circuit is not part of permanent wiring. All equipment must be suitable and approved for the class of hazard present.
- The PM or FL and appropriate personnel from other contractors will review site access routes and work locations for adequate clearance (overhead and laterally) slope, and ground stability prior to moving equipment on-site.

12.1.2 Slip/Trip/Fall

Observe the following procedures and practices to prevent slips, trips, and falls:

- Inspect each work area for slip/trip/fall potential prior to each work task.
- Slip/trip/fall hazards identified must be communicated to all personnel. Hazards identified shall be corrected or labeled with warning signs to be avoided.
- All personnel must be aware of their surroundings and maintain constant communication with each other at all times.

12.1.3 Underground/Overhead Utility Line Contact Prevention

Observe the following underground/overhead utility line contact prevention procedures and practices:

- Prior to conducting work, the PM or FL shall ensure that all existing underground or overhead utilities in the work area are located per the state or local mark-out methods, including identification of utility lines that may be submerged in waterways. Documentation of utility mark-out shall be completed using a Utility Contact Prevention Checklist form. No excavation work is to be performed until all utility mark-outs are verified.
- The PM or FL shall conduct a site survey to search for signs of other buried or overhead utilities. The results of such surveys shall be documented on the Utility Mark-out documentation form.
- The property owner or facility operator shall be consulted on the issue of underground utilities. As-built drawings shall be reviewed, when available, to verify that underground utility locations are consistent with the utility location mark-outs. All knowledge of past and present utilities must be evaluated prior to conducting work.
- If on-site subsurface utility locations are in question, a private locating service shall be contacted to verify locations. If the investigation calls for boreholes in an area not covered by the municipal One-Call system, then a private utility locate firm shall be contacted to determine the location of other underground utilities.
- The PM shall have documented verbal contact and an agreement with the fiber optic company for all work within 50 feet of any fiber optic cables.

- **Only hand digging is permitted within 3 feet of underground high voltage, product, or gas lines.** Once the line is exposed, heavy equipment can be used, but must remain at least 3 feet from the exposed line.
- Elevated superstructures (e.g., drill rig, backhoe, scaffolding, ladders, and cranes) shall remain a distance of 200 feet away from utility lines and 30 feet away from power lines. Distance from utility lines may be adjusted by the FL depending on actual voltage of the lines.
- Overhead utility locations shall be marked with warning tape or flags where equipment has the potential for contacting overhead utilities.

12.1.4 Electric Shock

Observe the following procedures and practices to prevent electric shock:

- Use GFCIs as required.
- Perform lockout/tagout (LO/TO) procedures in accordance with regulatory requirements, if applicable.
- Use three-pronged plugs and extension cords.
- Contact your local underground utility-locating service.
- Follow code requirements for electrical installations in hazardous locations.
- Always use qualified electricians to install electrical equipment and when conducting troubleshooting activities within 10 feet of exposed live wires.

12.1.5 Hand and Power Tools

Observe the following procedures and practices when working with hand and power tools:

- Keep hand tools sharp, clean, oiled, dressed, and not abused.
- Worn tools are dangerous. For example, the “teeth” in a pipe wrench can slip if worn smooth, an adjustable wrench will slip if the jaws are sprung, and hammerheads can fly off loose handles.
- Tools subject to impact (e.g., chisels, star drills, and caulking irons) tend to “mushroom.” Keep them dressed to avoid flying spalls. Use tool holders.
- Do not force tools beyond their capacity.

- Flying objects can result from operating almost any power tool, so always warn people in the vicinity and use proper eye protection.
- Each power tool should be examined before use for damaged parts, loose fittings, and frayed or cut electric cords. Tag and return defective tools for repairs. Also inspect for adequate lighting, proper lubrication, and abandoned tools or material that could “vibrate into trouble.”
- Compressed air must be shut off or the electric cord unplugged before making tool adjustments. Air must be “bled down” before replacement or disconnection.
- Proper guards or shields must be installed on all power tools before issue. Do not use improper tools or tools without guards in place.
- Replace all guards before start-up. Remove cranks, keys, or wrenches used in service work.

12.1.6 Vehicular Traffic

Observe the following procedures and practices regarding vehicular traffic:

- Wear a traffic safety vest when vehicle hazards exist.
- Use cones, flags, barricades, and caution tape to define the work area.
- Use a vehicle to block work area.
- Engage a police detail for high-traffic situations.
- Always use a spotter in tight or congested areas for material deliveries.
- As necessary, develop traffic control plans and train personnel as flaggers in accordance with the DOT MUTCD and/or local requirements.

See Section 7.4.2 for additional information regarding work in roadways.

12.1.7 Boating Operations

The following precautions shall be followed when conducting boating trailer and launch activities:

- Follow the trailer and boat manufacturers’ instructions for securing the boat to the trailer.

- Follow the trailer manufacturer's instructions for securing the trailer to the towing vehicle.
- Prohibit workers from moving into trailer/vehicle pinch points without advising the vehicle operator.
- Use experienced operators when backing trailers on boat ramps.
- Wear proper work gloves when the possibility of pinching or other injury may be caused by moving or handling large or heavy objects.
- Maintain all equipment in a safe condition.
- Launch boats one at a time to avoid collisions.
- Use a spotter for vehicles backing boats to the launch area.
- Understand and review hand signals.
- Wear boots with non-slip soles when launching boats.
- Wear USCG-approved PFDs when working on or near the water.
- Keep ropes and lines coiled and stowed to eliminate trip hazards.
- Maintain three-point contact on dock/pier or boat ladders.
- Ensure that drain plugs are in place, as present.

The following precautions shall be followed when conducting boating operations:

- Maintain a current boater's license(s) as required.
- Wear USCG-approved PFDs for work activities on or near the water.
- Provide a floating ring buoy with at least 90 feet of line in the immediate boat launch/landing areas.
- Step into the center of the boat (small boats only).
- Keep your weight low when moving on the boat (small boats only).
- Move slowly and deliberately.
- Steer directly across other boat wakes at a 90-degree angle to avoid capsizing.
- Steer the boat facing forward.
- Watch for floating objects in the water.
- Right-of-way is yielded to vessels on your boat's right, or starboard, and vessels with limited ability to maneuver such as any wind-propelled vessel.

The following precautions shall be followed when working on a boat:

- Observe proper lifting techniques.
- Obey lifting limits.
- Use mechanical lifting equipment (i.e., pulleys or winches) to move large or awkward loads.
- Wear USCG-approved PFDs for work activities on or near the water.

The safety-related items listed in Table 12-1 shall be available when conducting boating operations:

Table 12-1
Safety Equipment Specific to In-water Work

Additional Safety Equipment for Sampling Vessel per U.S. Coast Guard (USCG) Requirements:	
<ul style="list-style-type: none"> • Proper vessel registration, numbering, and documentation (registered with state, certificate of vessel registration number displayed, and carrying a valid certificate of number) • USCG-approved personal flotation devices (PFDs; or life jackets) for every person on the sampling vessel (Type II PFD required, Type I PFD preferred as it will turn most unconscious wearers face up in the water) • Appropriate, non-expired, visual distress devices for day and night use from the following: <ul style="list-style-type: none"> - Three hand-held red flares (day and night), or - One hand-held red flare and two parachute flares (day and night), or - One hand-held orange smoke signal, two floating orange smoke signals (day), and one electric distress light (night only) • Alternate means of propulsion (oars or paddles) • Dewatering device (pump or bailer) • Properly maintained and inspected USCG-approved fire extinguishers (no fixed system = (2) B-1 or (1) B-2 type extinguishers; fixed system = (1) B-1 type extinguisher) • Proper ventilation of gasoline-powered vessels • Sound-producing device (whistle, bell, or horn) • VHF 2-way radio or cellular telephone • Proper navigational light display • Throwable life ring with attached line (any vessel larger than 16 feet is required to carry one Type IV [throwable] PFD) 	
Additional USCG Recommended Equipment Includes:	
<ul style="list-style-type: none"> • Extra visual distress signals • Primary and spare anchor • Heaving line • Fenders • First aid kit • Flashlight • Mirror • Searchlight • Sunburn lotion • Tool kit • Spare fuel 	<ul style="list-style-type: none"> • Boat hook • Spare propeller • Mooring line • Food and water • Binoculars • Spare batteries • Sunglasses • Marine hardware • Extra clothing • Spare parts • Pertinent navigational chart(s) and compass

12.1.8 Working Over or Near Water

12.1.8.1 Personal Flotation Devices

Type III, Type V, or better USCG-approved PFD shall be provided and properly worn by all personnel in the following circumstances:

1. On floating pipelines, pontoons, rafts, or stages.
2. On structures extending over or next to the water, except where guard rails or safety nets are provided for employees.
3. Working alone at night where there are drowning hazards, regardless of other safeguards provided.
4. In skiffs, small boats, or launches, unless in an enclosed cabin or cockpit.
5. Whenever there is a drowning hazard.

The following precautions shall be followed when using PFDs:

- Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective devices or devices with less than 13 pounds buoyancy shall be removed from service.
- All PFDs shall be equipped with reflective tape as specified in 46 CFR 25.25-15.
- Thirty-inch USCG-approved ring buoys with at least 150 feet of 600-pound capacity line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet.
- PFD lights conforming to 46 CFR 161.012 shall be required whenever there is a potential need for life rings to be used after dark. On shore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights or light stanchions) is not provided.

12.1.9 Excavation and Trenching Activities

12.1.9.1 Definitions

Angle of Repose – The greatest angle above the horizontal plane at which a material will lie without sliding.

Benching – A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels of steps, usually with vertical or near-vertical surfaces between levels.

Competent Person – An employee who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate them.

Excavation – Any man-made cut, cavity, trench, or depression in an earth surface, including its sides, walls, or faces, formed by earth removal.

Registered Professional Engineer – An individual currently registered as a P.E. (preferably civil) in the state where work is to be performed.

Sheeting – Members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield – A structure that is able to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields may be pre-manufactured or job-built in accordance with CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring – Structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and that is designed to prevent cave-ins.

Sloping – A method of protecting employees from cave-ins by excavating to form sides of a trench that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Support System – A structure such as underpinning, bracing, or shoring, that provides support to an adjacent structure, underground installation, or the sides of an excavation.

Trench – A narrow (in relation to its length) excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.

Type A Soil – Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) (144 kilopascal [kPa]) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam, and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, soil is NOT Type A if:

- The soil is fissured
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects
- The soil has been previously disturbed
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of 4H:1V or greater
- The material is subjected to other factors that would require it to be classified as a less stable material

Type B Soil – This classification refers to:

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa), but less than 1.5 tsf (144 kPa)
- Granular, cohesionless soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and, in some cases, silty clay loam and sandy clay loam
- Previously disturbed soils except those that would otherwise be classified as Type C soil
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration
- Dry rock that is not stable
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than 4H:1V, but only if the material would otherwise be classified as Type B

Type C Soil – This classification refers to:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less
- Granular soils including gravel, sand, and loamy sand
- Submerged soil or soil from which water is freely seeping
- Submerged rock that is not stable
- Material in a sloped, layered system where the layers dip into the excavation or a slope of 4H:1V or steeper

12.1.9.2 *Pre-Excavation Requirements*

Underground Installations – Prior to opening an excavation, the estimated locations of underground utilities such as sewer, telephone, fuel, electric, water, or any other underground installations that may reasonably be expected to be encountered during the excavation work shall be determined.

The property owner and/or utility location service shall be contacted within the established pre-notification time, advised of the proposed work, and asked to delineate the location of all underground utilities. Employees should be careful to protect and preserve the utility markings until they are no longer required for safe excavation. At least 3 feet of clearance between any underground utility and the cutting edge or point of powered excavation equipment will be maintained until the precise location of the utility is determined. Initial excavation within this 3-foot area will be conducted manually.

Surface Encumbrances – All surface encumbrances (e.g., trees, poles, or boulders) that may create a hazard to employees shall be removed or supported.

Vehicular Traffic – Employees exposed to vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material. Traffic control devices (e.g., barricades, signs, cones, or flagpersons) shall be specified and used in accordance with regulations applicable to the roadway or area in which excavation activities are occurring.

12.1.9.3 Training

Those who supervise the entry of personnel into an excavation, a "Competent Person," must have completed a training course that included instruction in:

- Types of hazards associated with excavation operations
- Safe work practices and techniques
- A review of applicable federal, state, and local regulations
- A review of this procedure

Employees who enter excavations are required to complete a site-specific training session to enable them to recognize unsafe conditions in and around the excavation. This training can be conducted during a tailgate safety meeting that emphasizes the specific excavation hazards that may be encountered.

Training documentation shall be maintained in the project files. As part of the standard employee supervision process, training shall be complemented with on-the-job instruction and reinforcement of accepted practices to the extent necessary to ensure compliance with this procedure and all other applicable regulations.

12.1.9.4 Excavation Work Practices

General – Each employee working within an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with 29 CFR 1926 Subpart P, except when the excavation is made entirely in stable rock or when the excavation is less than 5 feet deep and examination of the ground by a competent person provides no indication of a potential cave-in. A competent person shall ensure that protective systems, when required, are installed and maintained per the design specifications. No employees shall be permitted to enter an excavation unless it is absolutely essential to do so and all requirements of this procedure are met.

Supervision – Work in an excavation shall be supervised at all times by a competent person. This individual will remain outside of the excavation at all times, and will be responsible for identifying any unusual developments aboveground that may warn of impending earth movement.

Soil Classification – Based on their training, the competent person will classify each soil or rock deposit as stable rock, Type A, Type B, or Type C. When layers of soil or rock exist, the weakest layer will be classified; however, each layer may be classified individually when a more stable layer lies under a less stable layer. If the properties or conditions of a soil or rock deposit change in any way, re-evaluation will be required.

Access and Egress – Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 or more feet in depth so as to require no more than 25 feet of lateral travel for employees.

Protective Systems – Protective systems shall be designed in accordance with 29 CFR 1926.652(b) or (c) and shall have the capacity to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

Exposure to Falling Loads – No employees shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded provided the vehicles are equipped with a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.

Warning System for Mobile Equipment – When mobile equipment is operated adjacent to an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs.

Hazardous Atmospheres – Where an oxygen-deficient (less than 19.5% O₂) or hazardous atmosphere exists, or could reasonably be expected to exist, the excavation shall be tested

before employees enter. Testing shall be conducted as often as necessary to ensure that the atmosphere remains safe. Some excavations may be considered confined spaces that require compliance with appropriate procedures. If entry into a confined space is required, work will be suspended until this HASP is amended to include appropriate procedures. Adequate precautions shall be taken to prevent employee exposure to oxygen-deficient or hazardous atmospheres.

Water Accumulation Hazards – Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. If water is controlled or prevented from accumulating by the use of water removal equipment, the process shall be monitored by a competent person to ensure proper operation.

If the excavation work interrupts the natural drainage of surface water (e.g., streams or run-off channels), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to run-off from heavy rains shall be regularly inspected by a competent person.

Stability of Adjacent Structures – Structures adjoining an excavation shall be evaluated to assess their stability. Excavation below the level of the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to employees shall only be permitted when:

- A support system (underpinning) is provided to ensure the safety of employees and the stability of the structure
- The excavation is in stable rock
- A registered P.E. has determined that the structure will be unaffected by the excavation
- A registered P.E. has determined that such excavation will not pose a hazard to employees

Sidewalks, pavements, and other surface structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

Protection from Loose Rock or Soil – Employees shall be protected from loose rock or soil that could fall or roll from the excavation face or edge. Such protection could consist of scaling to remove loose materials, or the installation of protective barriers. All spoil shall be placed at least 2 feet from the edge of the excavation. It is strongly recommended that spoil be placed 4 or more feet from the excavation edge so as not to cover surface indicators of subsidence (such as fissures or cracks).

Inspections – A competent person shall make daily inspections of excavations, adjacent areas, and protective systems for evidence of conditions that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. The inspection shall be made prior to start of work, and as needed throughout the shift. Inspections shall be made after each rainstorm or other hazard-increasing event, and will be documented. Where the inspection finds evidence of any hazardous condition, exposed employees shall immediately be removed from the hazardous area until necessary precautions have been taken.

Fall Protection – Where employees or equipment are permitted to cross over excavations, walkways or bridges shall be provided. Standard guard rails shall be provided where walkways are 6 feet or more above lower levels. Adequate barriers or other types of physical protection shall be provided at all remotely located excavations. All wells, pits, or shafts, shall be barricaded or covered, and shall be backfilled as soon as possible.

12.1.10 Noise

Excessive noise is hazardous not only because of its potential to damage hearing, but also because of its potential to disrupt communications and instructions. The following procedures and practices shall be followed to prevent noise-related hazards:

- All employees will have access to disposal ear plugs with a Noise Reduction Rating of not less than 30.

- Ear plugs must be worn in any environment where workers must raise their voices to be heard while standing at a distance of 3 feet or less.
- Ear plugs must be worn by any personnel operating concrete cutting or sawing equipment.

12.1.11 Lifting and Material Handling

Observe the following procedures and practices for lifting and material handling:

- Use leather gloves when handling metal, wire rope, sharp debris, or transporting materials (e.g., wood, piping, drums, etc.). Chemically protective gloves must be worn in addition to leather gloves if contaminated materials are handled; leather gloves to not offer adequate protection from COCs with dermal exposure routes of concern.
- The size, shape, and weight of the object to be lifted must first be considered. No individual employee is permitted to lift any object that weighs over 60 pounds. Multiple employees or mechanical lifting devices are required for objects over the 60-pound limit.
- Plan a lift before doing it. Bend at the knees and lift with the legs; keep the natural curves of the back; do not use back muscles.
- Check the planned route for clearance.
- Use the buddy system when lifting heavy or awkward objects.
- Do not twist your body while lifting.
- Know the capacity of any handling device (e.g., crane, forklift, chain fall, or come-along) that you intend to use.
- Use tag lines to control loads.
- Ensure that your body, material, tools, and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, bowing, or any other uncontrolled motion.
- Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released.
- Chock all material and equipment (such as pipe, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling.
- Tie down all light, large-surface-area material that might be moved by the wind.

- When working at heights, secure tools, equipment, and wrenches against falling.
- Do not store materials or tools on ducts, lighting fixtures, beam flanges, hung ceilings, or similar elevated locations.
- Fuel-powered tools used inside buildings or enclosures shall be vented and checked for excessive noise.

12.1.12 Fire Control

Observe the following fire control procedures and practices:

- Smoke only in designated areas.
- Keep flammable liquids in closed containers.
- Keep the work site clean; avoid accumulating combustible debris such as paper.
- Obtain and follow property owner hot work safety procedures when welding or performing other activities requiring an open flame.
- Isolate flammable and combustible materials from ignition sources.
- Ensure fire safety integrity of equipment installations according to NEC specifications.

12.1.13 Static Electricity and Transfer of Flammable Liquids

Observe the following procedures and practices regarding static electricity when transferring flammable liquids:

- Electrically bond and ground pumps, transfer vessels, tanks, drums, bailers, and probes when moving flammable liquids.
- Electrically bond and ground vacuum trucks and the tanks they are emptying.
- Do not splash fill containers with flammable liquids.
- Pour flammable liquids slowly and carefully.
- Two fire extinguishers (2A20:BC) must be available, charged, inspected, and readily accessible.

12.1.14 Cleaning Equipment

Observe the following procedures and practices when cleaning equipment:

- Wear appropriate PPE to avoid skin and eye contact with isopropyl alcohol, Alconox®, or other cleaning materials.
- Stand upwind to minimize any potential inhalation exposure.
- Dispose of spent cleaning solutions and rinses accordingly.

12.2 Environmental Hazards and Controls

12.2.1 Heat Stress

Observe the following general procedures and practices regarding heat stress:

- Increase the number of rest breaks and/or rotate workers in shorter work shifts.
- Watch for signs and symptoms of heat stress and fatigue (see Section 12.2.1.1).
- During hot months, plan work for early morning or evening.
- Use ice vests when necessary.
- Rest in cool, dry areas.

12.2.1.1 Signs, Symptoms, and Treatment

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, and increased accident probability to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn since they prevent evaporative body cooling. Wearing PPE places employees at considerable risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses, regular monitoring and other preventive precautions are vital.

Heat Rash. Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat-soaked clothing. The condition is characterized by a localized red skin rash and reduced sweating. Heat rash reduces the ability to tolerate heat. To treat, keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.

Heat Cramps. Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood, which can cause painful muscle spasms and pain in the extremities and abdomen. To treat, remove the employee to a cool place and give sips of water or an electrolytic drink. Watch for signs of heat exhaustion or heat stroke.

Heat Exhaustion. Heat exhaustion is a mild form of shock caused by increased stress on various organs to meet increased demand to cool the body. Onset is gradual and symptoms should subside within 1 hour. Symptoms include a weak pulse; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; and fatigue. To treat, remove the employee to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continuously to remove heat by convection. Do not allow the affected person to become chilled. Treat for shock if necessary.

Heat Stroke. Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. ***This is a medical emergency!*** Symptoms include red, hot, dry skin; a body temperature of 105° F or higher; no perspiration; nausea; dizziness and confusion; and a strong, rapid pulse. Since heat stroke is a true medical emergency, transport the patient to a medical facility immediately. Prior to transport, remove as much clothing as possible and wrap the patient in a sheet soaked with water. Fan the patient vigorously while transporting to help reduce body temperature. If available, apply cold packs under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing the patient in a cool-water bath (however, be careful not to over-chill the patient once body temperature is reduced below 102° F). If this is not possible, keep the patient wrapped in a sheet and continuously douse with water and fan.

12.2.1.2 Prevention

The implementation of preventative measures is the most effective way to limit the effects of heat-related illnesses. During periods of high heat, adequate liquids must be provided to replace lost body fluids. Replacement fluids can be a 0.1% saltwater solution, a commercial mix such as Gatorade, or a combination of these with fresh water. The replacement fluid

temperature should be kept cool, 50° F to 60° F, and should be placed close to the work area. Employees must be encouraged to drink more than the amount required to satisfy thirst. Employees should also be encouraged to salt their foods more heavily during hot times of the year.

Cooling devices such as vortex tubes or cooling vests can be worn beneath impermeable clothing. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

All workers are to rest when any symptoms of heat stress are noticed. Rest breaks are to be taken in a cool, shaded rest area. Employees shall remove chemical protective garments during rest periods and will not be assigned other tasks.

All employees shall be informed of the importance of adequate rest and proper diet, including the harmful effects of excessive alcohol and caffeine consumption.

12.2.1.3 *Monitoring*

Heat stress monitoring should be performed when employees are working in environments exceeding 90° F ambient air temperature. If employees are wearing impermeable clothing, this monitoring should begin at 77° F. There are two general types of monitoring that the health and safety representative can designate to be used: wet bulb globe temperature (WBGT), and physiological. A Heat Stress Monitoring Record form will be used to record the results of heat stress monitoring.

Wet Bulb Globe Temperature (WBGT). The WBGT index is the simplest and most suitable technique to measure the environmental factors that most nearly correlate with core body temperature and other physiological responses to heat. When WBGT exceeds 25° C (77° F), the work regiment in Table 12-2 should be followed.

Table 12-2
Permissible Heat Exposure Threshold Limit Values

Work/Rest Regimen	Workload		
	Light	Moderate	Heavy
Continuous work	86° F (30.0° C)	80° F (26.7° C)	77° F (25.0° C)
75% work, 25% rest each hour	87° F (30.6° C)	82° F (28.0° C)	78° F (25.9° C)
50% work, 50% rest, each hour	89° F (31.4° C)	85° F (29.4° C)	82° F (27.9° C)
25% work, 75% rest, each hour	90° F (32.2° C)	88° F (31.1° C)	86° F (30.0° C)
These TLVs are based on the assumption that nearly all acclimated, fully-clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 100.4° F (38° C).			

(From OSHA Technical Manual, Section III: Chapter 4 - Heat Stress)

The TLVs denoted in Table 12-2 apply to physically fit and acclimatized individuals wearing light, summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLVs should be adjusted based on the WBGT Correction Factors in Table 12-3.

Table 12-3
WBGT Correction Factors

Clothing Type	WBGT Correction
Summer lightweight working clothing	32° F (0° C)
Cotton coveralls	28° F (-2° C)
Winter work clothing	25° F (-4° C)
Water barrier, permeable	86° F (-6° C)
Fully encapsulating	14° F (-10° C)

Physiological. Physiological monitoring can be used in lieu of, or in addition to, WBGT. This monitoring can be self-performed once the health and safety representative demonstrates appropriate techniques to affected employees. Since individuals vary in their susceptibility to heat, this type of monitoring has its advantages. The two parameters that are to be monitored at the beginning of each rest period are:

- **Heart Rate** – The maximum heart rate (MHR) is the amount of work (beats) per minute a healthy person's heart can be expected to safely deliver. Each individual will count his/her radial (wrist) pulse for 1 minute as early as possible during each rest period. If the heart rate of any individual exceeds 75% of their calculated MHR ($MHR = 200 - \text{age}$) at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work until his/her sustained heart rate is below 75% of their calculated MHR.
- **Temperature** – Each individual will measure his/her temperature with a thermometer for 1 minute as early as possible in the first rest period. If the temperature exceeds 99.6° F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work if his/her temperature exceeds 100.4° F

12.2.1.4 Training

Employees potentially exposed to heat stress conditions will be instructed on the contents of this procedure. This training can be conducted during daily tailgate safety meetings.

12.2.2 Cold Stress

Observe the following procedures and practices regarding cold stress:

- Take breaks in heated shelters when working in extremely cold temperatures.
- Upon entering the shelter, remove the outer layer of clothing and loosen other layers to promote evaporation of perspiration.
- Drink warm liquids to reduce the susceptibility to cold stress.
- Be aware of cold stress symptoms, including shivering, numbness in the extremities, and sluggishness.
- Provide adequate insulating dry clothing to maintain warmth if work is performed in air temperature below 40° F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.
- If the air temperature is 32° F or less, hands should be protected.

- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer wear should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer by sweat.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.
- Implement a buddy system in which workers are responsible for observing fellow workers for early signs and symptoms of cold stress.

12.2.2.1 Signs, Symptoms, and Treatment

Cold stress can range from frostbite to hypothermia. The signs and symptoms of cold stress are listed below. The appropriate guidelines should be followed if any personnel exhibit these symptoms:

Frostbite. Frostbite is characterized by pain in the extremities and loss of manual dexterity. "Frostnip," or reddening of the tissue, is accompanied by a tingling or loss of sensation in the extremities and continuous shivering.

Hypothermia. Hypothermia is characterized by pain in the extremities and loss of manual dexterity, with severe, uncontrollable shivering, and an inability to maintain the level of activity. Symptoms include excessive fatigue, drowsiness, irritability, or euphoria. Severe hypothermia includes clouded consciousness, low blood pressure, pupil dilation, cessation of shivering, unconsciousness, and possible death.

Remove the patient to a warm, dry place. If the patient's clothing is wet, remove it and replace it with dry clothing. Keep the patient warm. Re-warming of the patient should be gradual to avoid stroke symptoms. Dehydration, or the loss of body fluids, may result in a cold injury due to a significant change in blood flow to the extremities. If the patient is conscious and alert, warm sweet liquids should be provided. Coffee and other caffeinated

liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep the patient warm and calm and remove them to a medical facility as soon as possible.

12.2.3 Inclement Weather

Observe the following procedures and practices regarding inclement weather:

- Stop outdoor work during electrical storms (lightning strikes), hailstorms, high winds, and other extreme weather conditions such as extreme heat or cold
- Take cover indoors or in a vehicle
- Listen to local forecasts for warnings about specific weather hazards such as tornadoes, hurricanes, and flash floods



12.2.4 Insects/Spiders

Observe the following general procedures and practices regarding insects/spiders:

- Tuck pants into socks
- Wear long sleeves
- Use insect repellent
- Avoid contact by always looking ahead to where you will be walking, standing, sitting, leaning, grabbing, lifting, or reaching
- Check for signs of insect/spider bites, such as redness, swelling, and flu-like symptoms

The most dangerous spiders to humans in North America are black widows and brown spiders (also known as brown recluse or fiddleback spiders). A guide to identifying these spiders is presented in Table 12-4.

Table 12-4
North American Hazardous Spider Identification Guide

Hazardous Spider Identification Guide	
<p>Black Widow Spider</p> <ul style="list-style-type: none"> • Abdomen usually shows hourglass marking. • Female is 3 to 4 centimeters in diameter. • Have been found in well casings and flush-mount covers. • Not aggressive, but more likely to bite if guarding eggs. • Light, local swelling and reddening are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea. • If bitten, see a physician as soon as possible. 	
<p>Brown Spiders (aka Brown Recluse or Fiddleback)</p> <ul style="list-style-type: none"> • Found in the central and southern United States, although in some other areas, as well. • 1/4-to-1/2-inch-long body and size of a silver dollar. • Hide in baseboards, ceiling cracks, and undisturbed piles of material. • Bite may either go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of the affected tissue, and very slow healing. • If bitten, see a physician as soon as possible. 	

12.2.5 Bees and Wasps

Many encounters with bees and wasps occur when nests built in well casings or excavation areas are disturbed. Before opening a well casing, take a few moments to observe whether or not insects are entering or exiting. If they are flying to and from the casing, avoid it if possible. If you must be in an area where disturbing a nest is likely, be sure to wear long pants and a long-sleeved shirt. Stinging insects fly around the top of their target, so if you get into trouble, pull a portion of your shirt over your head and run away.

If you get stung, look for a stinger, and, if present, remove it as soon as possible. Several over-the-counter products or a simple cold compress can be used to alleviate the pain of the

sting. If the sting is followed by severe symptoms, or if it occurs in the neck or the mouth, seek medical attention immediately because swelling could cause suffocation.

If you need to destroy a nest, consult with the PM and project FL first. Commercially available stinging insect control aerosols are very effective, but could potentially contaminate the well. Once the nest is destroyed, fine mesh may be applied over the exit and entry points of a well casing to prevent re-infestation.

12.2.6 Ticks

Ticks in North America can be carriers of several diseases, including Lyme's Disease, Rocky Mountain Spotted Fever, and ehrlichiosis.

Limiting exposure to ticks reduces the likelihood of infection when exposed to tick-infested habitats. Measures to prevent tick exposure include the following:

- Remove leaf litter and brush in areas where you will be working prior to tick season.
- Wear light-colored clothing so that ticks are visible.
- Tuck your pant legs into your socks.
- Apply repellents to discourage tick attachment.
- Promptly inspect your body and remove crawling or attached ticks when you leave a tick-infested area.
- Conduct tick checks on buddies upon exiting any suspect area (may be needed multiple times per work day).
- Be aware of seasonal activity; ticks are often most active in the spring.

Observe the following procedures and practices if you are bitten by a tick:

- Use fine-tipped tweezers or shield your fingers with tissue, paper towel, or rubber gloves.
- Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause mouthparts to break off and remain in the skin.
- Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms.

- Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin.
- After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
- You may wish to save the tick for identification in case you become ill within 2 to 3 weeks. Place the tick in a sealed plastic bag in the freezer, and mark the bag with the date of the bite.

12.2.7 Mosquitoes

Mosquitoes in the United States have been known to carry West Nile Virus, St. Louis encephalitis, and Dengue Fever. To avoid mosquito bites:

- Apply insect repellent containing DEET (N,N-diethyl-meta-toluamide) when outdoors. DEET is very effective, but could potentially contaminate samples.
- Read and follow the product directions whenever you use insect repellent.
- Wear long-sleeved clothes and long pants treated with repellent to further reduce your risk, or stay indoors during peak mosquito feeding hours (dusk until dawn).
- Limit the number of places available for mosquitoes to lay their eggs by eliminating standing water sources from around the work area.
- If you need to destroy a nest, consult with the PM and project FL first.
- Check to see if there is an organized mosquito control program near the project site. If no program exists, work with the local government officials to establish a program.

12.2.8 Poisonous Snakes

Observe the following procedures and practices regarding poisonous snakes:

- Avoid walking in areas where snakes may nest or hide. When walking, always look ahead for signs of snakes.
- Use extreme caution when moving or lifting objects that could be used by snakes as cover.
- Never reach under or behind objects or into other areas where snakes may hide.
- Wear sturdy leather boots.

- Poisonous snakebites are medical emergencies. If bitten by any type of snake, immediately seek medical attention.

12.2.9 Waterborne Pathogens

A potentially life-threatening bacterium, *Vibrio vulnificus*, occurs naturally in estuarine and marine waters and in associated filter-feeding shellfish, such as oysters and mussels. The organism is able to cause infection through ingestion or through a wound. *Vibrio vulnificus* is common in Texas coastal waters from May to September (when waters are the warmest). Most healthy people are resistant to infection with this bacterium. Those who are at risk are persons with underlying diseases (especially liver diseases), blood disorders, diabetes, cancer, or any condition that affects the immune system. Persons considered to be at risk for bacterial infections should not perform field tasks associated with this project.

The symptoms of developing a *Vibrio vulnificus* infection include, but may not be limited to:

- Fever and chills
- Redness and swelling of affected area
- Pain
- Decreased blood pressure
- Tissue destruction at the site of the wound

Persons developing a *Vibrio vulnificus* infection require immediate medical attention including antibiotics, and potentially the removal of affected tissue or limbs. To reduce the possibility of *Vibrio vulnificus* or any other infection during field activities, care shall be taken not to allow any exposure of cuts or abrasions to the waters of the project area or the equipment or samples that have been in contact with the waters. Any cuts or abrasions that occur while performing the sampling activities shall be immediately treated with a topical antibacterial agent and bandaged. Should the affected area exhibit redness, swelling, or any other abnormal symptom, immediate medical attention should be sought.

Potential parasitic hazards may be present in surface waters, sediment, and soil. These include, but are not limited to: roundworm, whipworm, and hookworm. People can become infected with intestinal worms through contact with soil that has been contaminated with

human or animal feces. Parasites can enter the body through ingestion as well as dermal contact. Hookworm larvae, which may be present in animal feces (including nutria [*Myocastor coypus*] feces), can burrow through skin. Intestinal parasites can cause symptoms such as:

- Diarrhea
- Abdominal cramps
- Loss of appetite
- Distended abdomen
- Coughing, fever, and vomiting







Anyone experiencing these or any abnormal symptoms should seek medical attention. To reduce the potential for exposure to parasites, skin contact with water and sediment/soil will be avoided through the use of rubber gloves or any other appropriate PPE.

12.2.10 Poisonous Plants

Poisonous plants include poison ivy, poison oak, and poison sumac as shown in Table 12-5. Observe the following procedures and practices regarding poisonous plants:

- Avoid entering areas infested with poisonous plants.
- Immediately wash any areas that come into contact with poisonous plants.
- Use PPE when there is a possibility of contact with poisonous plants.

Table 12-5
Hazardous Plant Identification Guide

Hazardous Plant Identification Guide		
Poison Ivy <ul style="list-style-type: none"> • Grows in West, Midwest, Texas, and the East Coast • Several forms—vine, trailing shrub, or shrub • Three leaflets (can vary from 3 to 9) • Leaves are green in summer, and red in fall • Yellow or green flowers • White berries 		
Poison Oak <ul style="list-style-type: none"> • Grows in the East (New Jersey to Texas) and Pacific Coast • 6-foot tall shrubs or long vines • Oak-like leaves in clusters of three • Yellow berries 		
Poison Sumac <ul style="list-style-type: none"> • Grows in boggy areas, especially in the Southwest and Northern states • Shrub up to 15 feet tall • Seven to 13 smooth-edged leaflets • Glossy pale yellow or cream-colored berries 		

If you have been exposed to poison ivy, oak, or sumac, act quickly because the toxin in the plants penetrates the skin within minutes. If possible, stay outdoors until you complete the first two steps:

1. Cleanse the exposed skin with generous amounts of isopropyl alcohol.
2. Wash the skin with water.
3. Take a regular shower with soap and warm water. Do not use soap until this point because it will pick up the toxin from the surface and move it around.
4. Wash clothes, tools, and anything else that may have been in contact with the toxin, with alcohol and water. Be sure to wear hand protection during that process.

Signs and symptoms of exposure include redness and swelling that appears 12 to 48 hours after exposure. Blistering and itching will follow. If you have had a severe reaction in the past, you should see a physician right away. Over-the-counter products that are available to alleviate symptoms include Cortaid®, Lanacort®, baking soda, Aveeno® oatmeal baths, and calamine lotion.

13 MEDICAL SURVEILLANCE PROGRAM

This section describes the medical surveillance program that Anchor QEA field personnel must comply with when working on sites where there is a potential for exposure to hazardous wastes or other hazardous substances.

13.1 General Requirements

Anchor QEA employees shall be enrolled in a medical surveillance program in compliance with OSHA standards (29 CFR 1910.120(f)) under the following circumstances:

If they are involved with any of the following operations:

- *Cleanup operations* required by a governmental body, whether federal, state, local, or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority List [NPL] sites, state priority list sites, sites recommended for the EPA NPL, and initial investigation of government-identified sites that are conducted before the presence or absence of hazardous substances has been ascertained).
- *Corrective actions* involving cleanup operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 U.S.C. 6901 et seq).
- *Voluntary cleanup operations* at sites recognized by federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites.
- *Operations involving hazardous wastes* that are conducted at treatment, storage, and disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA or by agencies under agreement with the EPA to implement RCRA regulations.
- *Emergency response operations* for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

And, if the employee(s) meets the following criteria:

- Are or may be exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more per year.

In addition, employees are required to be enrolled in the medical surveillance program if they meet any of the following conditions:

- Wear a respirator for 30 days or more per year
- Are injured, become ill, or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operations
- Are members of a Hazardous Materials (HAZMAT) team

Anchor QEA employees required to be enrolled in a medical surveillance program under 29 CFR 1910.120(f) shall have medical examinations and consultations made available to them by Anchor QEA on the following schedule:

- Prior to assignment
- At least once every 12 months unless the attending physician believes a longer interval (not greater than biennially) is appropriate
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 6 months
- As soon as possible upon notification that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the PEL or published exposure levels in an emergency situation
- At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary

The content of medical examinations or consultations made available to employees shall be determined by the attending physician but shall include, at a minimum, a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

The attending physician shall provide Anchor QEA with a written opinion for each examined employee that contains the following information:

- Whether the employee has any detected medical conditions that would place the employee at an increased risk of impairment of the employee's health from hazardous waste operations work, emergency response, or respirator use
- Any recommended limitations on the employee's assigned work
- A statement that the employee has been informed of the results of the medical examination and any medical conditions that require further examination or treatment

The written opinion obtained by Anchor QEA shall not reveal specific findings or diagnoses unrelated to occupational exposures. Medical surveillance and other employee-related medical records shall be retained for at least the duration of employment plus 30 years.

13.2 Crew Self Monitoring

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Symptoms of heat stress or heat exhaustion
- Symptoms of hypothermia

If any of these conditions develop, the affected person will be moved from the immediate work location and evaluated. If further assistance is needed, personnel at the local hospital

will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the result of sample collection or processing activities, procedures and/or PPE will be modified to address the problem.

APPENDIX A

HEALTH AND SAFETY LOGS AND FORMS



DATE: _____

PROJECT NAME: _____

PROJECT NO: _____

DAILY SAFETY BRIEFING

PERSON CONDUCTING
MEETING: _____

HEALTH & SAFETY
OFFICER: _____

PROJECT
MANAGER: _____

TOPICS COVERED:

- | | | |
|--|---|---|
| <input type="checkbox"/> Emergency Procedures and Evacuation Route | <input type="checkbox"/> Lines of Authority | <input type="checkbox"/> Lifting Techniques |
| <input type="checkbox"/> Directions to Hospital | <input type="checkbox"/> Communication | <input type="checkbox"/> Slips, Trips, and Falls |
| <input type="checkbox"/> HASP Review and Location | <input type="checkbox"/> Site Security | <input type="checkbox"/> Hazard Exposure Routes |
| <input type="checkbox"/> Safety Equipment Location | <input type="checkbox"/> Vessel Safety Protocols | <input type="checkbox"/> Heat and Cold Stress |
| <input type="checkbox"/> Proper Safety Equipment Use | <input type="checkbox"/> Work Zones | <input type="checkbox"/> Overhead and Underfoot Hazards |
| <input type="checkbox"/> Employee Right-to-Know/MSDS Location | <input type="checkbox"/> Vehicle Safety and Driving/Road Conditions | <input type="checkbox"/> Chemical Hazards |
| <input type="checkbox"/> Fire Extinguisher Location | <input type="checkbox"/> Equipment Safety and Operation | <input type="checkbox"/> Flammable Hazards |
| <input type="checkbox"/> Eye Wash Station Location | <input type="checkbox"/> Proper Use of PPE | <input type="checkbox"/> Biological Hazards |
| <input type="checkbox"/> Buddy System | <input type="checkbox"/> Decontamination Procedures | <input type="checkbox"/> Eating/Drinking/Smoking |
| <input type="checkbox"/> Self and Coworker Monitoring | <input type="checkbox"/> Other: | |

WEATHER CONDITIONS: _____

DAILY WORK SCOPE: _____

SITE-SPECIFIC HAZARDS: _____

SAFETY COMMENTS: _____

ATTENDEES

PRINTED NAME

SIGNATURE



MODIFICATION TO HEALTH AND SAFETY PLAN

DATE ____/____/____

Project: _____

Modification:

Reasons for Modification:

Site Personnel Briefed:

Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____

Approvals:

Site Supervisor: _____

Site Safety and Health Officer: _____

CERCLA Project Coordinator: _____

President: _____

Other: _____

[illegible]



UTILITY MARK-OUT DOCUMENTATION

Project Name: _____ Location: _____
Task/Activity: _____ Date: _____
Utility Called: _____ Confirmation #: _____
County of work: _____ Municipality of work: _____

Before work is done on any site, contact the appropriate local utility locating service (One Call, Miss Dig, Uloco, etc.) or a local utility contractor to have sub grade utilities marked. NOTE: Boring locations to be placed not in the public right of way are typically not marked out by the public utility mark-out, and a private utility locate service must be engaged. Indicate to the utility locator the nearest intersecting street for the site: _____

_____ Confirmation No: _____.

List utility firms (public and private) and the utility they will mark.

Utility Marker Emergency Telephone Numbers Major Utilities Marked by Color Code			
Name of Utility Company	Utility	Color Code	Emergency Telephone Number
	Water	Blue	
	Gas	Yellow	
	Electric	Red	
	Telephone/Cable/ Communication	Orange	
	Sewer	Green	

"ALL UNDERGROUND UTILITIES MAY NOT BE LOCATED BY THE LOCAL UTILITY SERVICE."
Accordingly, you must list other known utilities in the area that the "One Call" service will not contact:

Attach photos of the area prior to placing boreholes.

Take photos of the area indicating minimum 5 feet hand dig, post hole dig, probe, GPR, or other.

NOTE: For any borehole, should 5 feet minimum clearance not be obtained, you must contact Business Line VP or equivalent (Operations Director or other on the Federal Business Line) and obtain a variance.

Completed by:

Name Signature Date

APPENDIX B

MATERIAL SAFETY DATA SHEETS (MSDS)

Close

Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-044A

Last Updated: 11/14/2006

Section I Product Identification

Name: 1,2,3,4,6,7,8-Heptachlorodibenzofuran**Matrix:** neat compound

Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,4,6,7,8-heptachlorodibenzofuran	067562-39-4	100	N/A	N/A	N/A	N/A	G
Codes: A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.							

Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

All chemicals should be considered hazardous - direct physical contact should be avoided.

Section IV First Aid Measures

Inhalation:	If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.
Skin Contact:	In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.
Eye Contact:	In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.
Ingestion:	If ingested, contact poison center immediately for recommended procedure. Contact a physician.

Section V Fire Fighting Measures

Fire and Explosion Hazard Data for Compound

Fire Hazard: N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

Section VIII *Exposure Controls / Personal Protection*

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

Section IX *Physical and Chemical Properties*

Physical Data for Compound

Melting Pt.: N/A

Boiling Pt.: N/A

Density: N/A

Vapor Pressure: N/A

Vapor Density: N/A

Water Solubility: N/A

Appearance: N/A

Odor: N/A

Flash Point: N/A

Auto-Ignition Temperature: N/A

LEL: N/A

UEL: N/A

Section X *Stability and Reactivity*

Reactivity Data for Compound

Stability: stable

Incompatibilities: N/A

Hazardous Decomposition Products: N/A

Hazardous Effects of Polymerization: no

Section XI *Toxicological Information*

See Section II for specific toxicological information for the ingredients of this product.

Section XII *Ecological Information*

No information is available.

Section XIII *Disposal Considerations*

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

Section XIV *Transport Information*

Shipment Type: Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

UN Number: UN3316

Shipping Class: 9

Packing Group: N/A

Section XV *Regulatory Information*

No information is available.

Section XVI Other Information

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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Close

Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-063A

Last Updated: 11/14/2006

Section I Product Identification

Name: 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin

Matrix: neat compound

Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	035822-46-9	100	N/A	N/A	N/A	N/A	G

Codes: A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

Section III Hazards Identification

All chemicals should be considered hazardous - direct physical contact should be avoided.

Section IV First Aid Measures

Inhalation:	If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.
Skin Contact:	In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.
Eye Contact:	In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.
Ingestion:	If ingested, contact poison center immediately for recommended procedure. Contact a physician.

Section V Fire Fighting Measures

Fire and Explosion Hazard Data for Compound

Fire Hazard: N/A

Extinguishing Media: Carbon dioxide, dry chemical powder, or water spray.

Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

Section VIII *Exposure Controls / Personal Protection*

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

Section IX *Physical and Chemical Properties*

Physical Data for Compound

Melting Pt.: N/A

Boiling Pt.: N/A

Density: N/A

Vapor Pressure: N/A

Vapor Density: N/A

Water Solubility: N/A

Appearance: N/A

Odor: N/A

Flash Point: N/A

Auto-Ignition Temperature: N/A

LEL: N/A

UEL: N/A

Section X *Stability and Reactivity*

Reactivity Data for Compound

Stability: stable

Incompatibilities: N/A

Hazardous Decomposition Products: N/A

Hazardous Effects of Polymerization: no

Section XI *Toxicological Information*

See Section II for specific toxicological information for the ingredients of this product.

Section XII *Ecological Information*

No information is available.

Section XIII *Disposal Considerations*

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

Section XIV *Transport Information*

Shipment Type: Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

UN Number: UN3316

Shipping Class: 9

Packing Group: N/A

Section XV *Regulatory Information*

No information is available.

Section XVI *Other Information*

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-043A

Last Updated: 11/14/2006

Section I Product Identification

Name: 1,2,3,4,7,8-Hexachlorodibenzofuran**Matrix:** neat compound

Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,4,7,8-hexachlorodibenzofuran	070648-26-9	100	N/A	N/A	N/A	N/A	G

Codes: A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

Toxic

All chemicals should be considered hazardous - direct physical contact should be avoided.

Section IV First Aid Measures

Inhalation: If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.**Skin Contact:** In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.**Eye Contact:** In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.**Ingestion:** If ingested, contact poison center immediately for recommended procedure. Contact a physician.

Section V Fire Fighting Measures

Fire and Explosion Hazard Data for Compound

Fire Hazard: N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

Section VIII Exposure Controls / Personal Protection

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

Section IX Physical and Chemical Properties

Physical Data for Compound

Melting Pt.: N/A

Boiling Pt.: N/A

Density: N/A

Vapor Pressure: N/A

Vapor Density: N/A

Water Solubility: N/A

Appearance: N/A

Odor: N/A

Flash Point: N/A

Auto-Ignition Temperature: N/A

LEL: N/A

UEL: N/A

Section X Stability and Reactivity

Reactivity Data for Compound

Stability: stable

Incompatibilities: N/A

Hazardous Decomposition Products: N/A

Hazardous Effects of Polymerization: no

Section XI Toxicological Information

See Section II for specific toxicological information for the ingredients of this product.

Section XII Ecological Information

No information is available.

Section XIII Disposal Considerations

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

Section XIV Transport Information

Shipment Type: Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

UN Number: UN3316

Shipping Class: 9

Packing Group: N/A

Section XV Regulatory Information

No information is available.

Section XVI Other Information

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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Close

Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-058A

Last Updated: 11/14/2006

Section I Product Identification

Name: 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin

Matrix: neat compound

Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	039227-28-6	100	0.825 mg/kg oral rat	N/A	N/A	N/A	G
Codes: A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.							

Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

Toxic

All chemicals should be considered hazardous - direct physical contact should be avoided.

Section IV First Aid Measures

Inhalation: If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.

Skin Contact: In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.

Eye Contact: In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.

Ingestion: If ingested, contact poison center immediately for recommended procedure. Contact a physician.

Section V Fire Fighting Measures

Fire and Explosion Hazard Data for Compound

Fire Hazard: N/A

Extinguishing Media: Carbon dioxide, dry chemical powder, or water spray.

Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

Section VIII Exposure Controls / Personal Protection

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

Section IX Physical and Chemical Properties

Physical Data for Compound

Melting Pt.: N/A

Boiling Pt.: N/A

Density: N/A

Vapor Pressure: N/A

Vapor Density: N/A

Water Solubility: N/A

Appearance: N/A

Odor: N/A

Flash Point: N/A

Auto-Ignition Temperature: N/A

LEL: N/A

UEL: N/A

Section X Stability and Reactivity

Reactivity Data for Compound

Stability: stable

Incompatibilities: N/A

Hazardous Decomposition Products: N/A

Hazardous Effects of Polymerization: no

Section XI Toxicological Information

See Section II for specific toxicological information for the ingredients of this product.

Section XII Ecological Information

No information is available.

Section XIII Disposal Considerations

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

Section XIV Transport Information

Shipment Type: Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

UN Number: UN3316

Shipping Class: 9

Packing Group: N/A

Section XV Regulatory Information

No information is available.

Section XVI Other Information

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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MATERIAL SAFETY DATA SHEET

MSDS Number
D-602N

 **AccuStandard**
125 Market Street • New Haven, CT USA 06513
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number
203-786-5290
Mon. to Fri. 8am-5pm EDT

Product Number : D-602N

Product Name : 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin

Synonyms : N/A

Formula : C₁₂ H₂ Cl₆ O₂

Molecular Weight : 390.84

Section 2 - Composition / Information on Ingredients

Component(s) (1)	CAS #	Appr. %	ACGIH TLV	OSHA PEL
			TWA mg/m ³ SKIN	TWA mg/m ³ SKIN
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	100%		

Section 3 - Hazards Identification

Symptoms of Exposure:

May be harmful if inhaled, swallowed, or absorbed through the skin.

Potential Health Effects:

No applicable information found.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

Suspected human carcinogenic substance. Suspect Cancer Hazard.

WARNING: This product contains a chemical(s) known to the state of California to cause cancer.

Section 4 - First Aid Measures

First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Remove contaminated clothing and wash before reuse

Section 5 - Fire Fighting Measures

Fire fighting measures for the Compound

Flammable Properties:

Flash Point (°F): N/A
 Flammable Limits LEL (%): N/A
 Flammable Limits UEL (%): N/A

Thermal decomposition produces toxic fumes.

Extinguishing Media:

Use water spray, dry chemical, CO₂, or "alcohol" foam.

Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

Section 6 - Accidental Release Measures

Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

Section 7 - Handling and Storage

Keep container closed.
 Store in a cool area away from ignition sources and oxidizers.
 Do not breathe vapor.
 Do not get in eyes, on skin, or on clothing.

Section 8 - Exposure Controls / Personal Protection

Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact.

(Butyl Rubber, Viton or equivalent)

Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

Section 9 - Physical and Chemical Properties

Physical and chemical properties for the Compound

Appearance: White crystals
 Boiling Point: N/A
 Melting Point: N/A
 Specific Gravity (Water = 1): N/A
 Vapor Pressure: N/A
 Vapor Density (Air = 1): N/A
 Percent Volatile (by volume): N/A
 Evaporation Rate (Butyl acetate = 1): N/A
 Flash Point: N/A
 Explosion Limits (%): N/A to N/A
 Solubility in water (%): N/A

Section 10 - Stability and Reactivity

Stability and reactivity for the Compound

Stability: Stable
 Materials to Avoid: Oxidizers
 Hazardous Decomposition: Oxides of carbon
 Hazardous Polymerization: Does not occur
 Conditions to Avoid:

Section 11 - Toxicological Information

See section 3 for specific toxicological information for the ingredients of this product.

Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

Section 14 - Transport Information

DOT Shipping Class: 6.1 Packing Group: II UN Number: UN2811

Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

None.

Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

* * * End of document * * *

MATERIAL SAFETY DATA SHEET

MSDS Number
D-605N

 **AccuStandard**
125 Market Street • New Haven, CT USA 06513
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number
203-786-5290
Mon. to Fri. 8am-5pm EDT

Product Number : D-605N

Product Name : 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin.

Synonyms : N/A

Formula : C₁₂H₂Cl₆O₂

Molecular Weight : N/A

Section 2 - Composition / Information on Ingredients

Component(s) (1)	CAS #	Appr. %	ACGIH TLV		OSHA PEL	
			TWA mg/m ³	SKIN	TWA mg/m ³	SKIN
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	100%				

Section 3 - Hazards Identification

Symptoms of Exposure:

Harmful if inhaled, swallowed, or absorbed through the skin.

Potential Health Effects:

No applicable information found.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

Proven animal carcinogenic substance. Possible Cancer Hazard.

Section 4 - First Aid Measures

First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Remove contaminated clothing and wash before reuse.

Section 5 - Fire Fighting Measures

Fire fighting measures for the Compound

Flammable Properties:

Flash Point (°F): N/A
 Flammable Limits LEL (%): N/A
 Flammable Limits UEL (%): N/A

Thermal decomposition produces toxic fumes.

Extinguishing Media:

Use water spray, dry chemical, CO₂, or "alcohol" foam.

Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

Section 6 - Accidental Release Measures

Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

Section 7 - Handling and Storage

Keep container closed.
 Store in a cool area away from ignition sources and oxidizers.
 Do not breathe vapor.
 Do not get in eyes, on skin, or on clothing.

Section 8 - Exposure Controls / Personal Protection

Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact.

(Butyl Rubber, Viton or equivalent)

Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

Section 9 - Physical and Chemical Properties

Physical and chemical properties for the Compound

Appearance: Orange powder.
 Boiling Point: N/A
 Melting Point: N/A
 Specific Gravity (Water = 1): N/A
 Vapor Pressure: N/A
 Vapor Density (Air = 1): N/A
 Percent Volatile (by volume): N/A
 Evaporation Rate (Butyl acetate = 1): N/A
 Flash Point: N/A
 Explosion Limits (%): N/A to N/A
 Solubility in water (%): Soluble

Section 10 - Stability and Reactivity

Stability and reactivity for the Compound

Stability: Stable
 Materials to Avoid: Oxidizers
 Hazardous Decomposition: Oxides of carbon
 Hazardous Polymerization: Does not occur
 Conditions to Avoid: None indicated

Section 11 - Toxicological Information

See section 3 for specific toxicological information for the ingredients of this product.

Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

Section 14 - Transport Information

DOT Shipping Class: 6.1 Packing Group: II UN Number: UN2811

Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

The CAS number of this product is NOT listed on the TSCA Inventory. For reasearch and development use only. Not for manufacturing or commercial purposes.

Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

* * * End of document * * *

Close

Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-042A

Last Updated: 11/14/2006

Section I Product Identification

Name: 1,2,3,7,8-Pentachlorodibenzofuran**Matrix:** neat compound

Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
1,2,3,7,8-pentachlorodibenzofuran	057117-41-6	100	N/A	N/A	N/A	N/A	G

Codes: A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

Toxic

All chemicals should be considered hazardous - direct physical contact should be avoided.

Section IV First Aid Measures

Inhalation: If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.**Skin Contact:** In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.**Eye Contact:** In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.**Ingestion:** If ingested, contact poison center immediately for recommended procedure. Contact a physician.

Section V Fire Fighting Measures

Fire and Explosion Hazard Data for Compound

Fire Hazard: N/A**Extinguishing Media:** Carbon dioxide, dry chemical powder, or water spray.

Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

Section VIII Exposure Controls / Personal Protection

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

Section IX Physical and Chemical Properties

Physical Data for Compound

Melting Pt.: N/A

Boiling Pt.: N/A

Density: N/A

Vapor Pressure: N/A

Vapor Density: N/A

Water Solubility: N/A

Appearance: N/A

Odor: N/A

Flash Point: N/A

Auto-Ignition Temperature: N/A

LEL: N/A

UEL: N/A

Section X Stability and Reactivity

Reactivity Data for Compound

Stability: stable

Incompatibilities: N/A

Hazardous Decomposition Products: N/A

Hazardous Effects of Polymerization: no

Section XI Toxicological Information

See Section II for specific toxicological information for the ingredients of this product.

Section XII Ecological Information

No information is available.

Section XIII Disposal Considerations

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

Section XIV Transport Information

Shipment Type: Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

UN Number: UN3316

Shipping Class: 9

Packing Group: N/A

Section XV Regulatory Information

No information is available.

Section XVI Other Information

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Company: AccuStandard, Inc.
125 Market Street
New Haven, CT 06513

Date MSDS Printed: 9/10/2007
Preparation Date: 9/10/2007
Information Phone Number: 203-786-5290
Emergency Phone Number: 203-786-5290
Hours: Mon. to Fri. 8am-5pm EDT

Catalog Number: D-501S

Product Name: 1,2,3,7,8-Pentachlorodibenzo-p-dioxin

Synonyms: N/A

Formula: N/A

Molecular Weight: N/A

SECTION 2 - COMPOSITION / INFORMATION ON INGREDIENTS

Component(s) (1)	CAS #	Appr. %	ACGIH-TLV (mg/m3)		OSHA-PEL (mg/m3)	
			TWA	STEL skin	TWA	STEL skin
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321-76-4	0.005				
Toluene	108-88-3	99.995	188	x		

SECTION 3 - HAZARDS IDENTIFICATION**Health and Environmental Hazards/Symptoms of Exposure:**

Exposure may cause lung irritation, chest pain, and pulmonary edema. Inhalation studies on toluene have demonstrated the development of inflammatory and ulcerous lesions of the penis, prepuce, and scrotum in animals. Vapors may cause drowsiness and dizziness. Aspiration of material into lungs can cause chemical pneumonitis.

HMIS® III	*	2	3	0	
NFPA		2	3	0	

Potential Health Effects:

May be irritating to eyes.
May be irritating to skin.
May be harmful if absorbed through the skin.
May be irritating to mucous membrane and upper respiratory system.
May be harmful if inhaled.
May be harmful if swallowed.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

Notification of carcinogenic ingredients in quantity less than 0.1% is not required under Federal Hazard Communication Law.
Contains one or more components that are classified (ACGIH, IARC, NTP, OSHA) as a possible cancer hazard in quantities less than 0.1%.

SECTION 4 - FIRST AID MEASURES**Emergency First Aid:**

Get medical assistance for all cases of overexposure.
Skin contact: Wash thoroughly with soap and water. Get medical attention if irritation develops or persists.
Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.
Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

Ingestion: Do NOT induce vomiting. Call a physician immediately. Never give anything by mouth to an unconscious person.

SECTION 5 - FIRE FIGHTING MEASURES

Flammable Properties:

Flash Point: 40 °F (4 °C) (cc)
Flammable Limits LEL (%): 1.3
Flammable Limits UEL (%): 7.1
Autoignition Temperature: 535 °C

Dangerous fire hazard.
Containers can build up pressure if exposed to heat.
Vapors can travel to a source of ignition and flash back.
During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.
Water spray to cool fire-exposed containers and disperse vapors.

Fire Fighting Procedures:

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Spill Response:

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container.
Store in a cool area away from ignition sources and oxidizers.
Electrically ground all equipment when handling this product.
Avoid breathing vapors or mists.
Use with adequate ventilation.
Do not get in eyes, on skin or clothing.
Avoid prolonged or repeated exposure.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls and Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material must be handled or transferred in an approved fume hood or with equivalent ventilation.
(Nitrile or equivalent)

Safety glasses with side shields must be worn at all times.
Safety glasses with side shields should be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid
Odor: Aromatic
pH: N/A

M A T E R I A L S A F E T Y D A T A S H E E T

Vapor Pressure: 21.9 mmHg (20 °C)
Vapor Density (Air = 1): 3.2 g/l
Boiling Point: 110.6 °C
Melting Point: -93 °C
Solubility in Water (%): Insoluble
Specific Gravity (H₂O = 1): 0.866 g/cm³
Flash Point: 40 °F (4 °C) (cc)
Explosion Limits (%): 1.3 to 7.1
Autoignition Temperature: 535 °C
Percent Volatile: 99+
Evaporation Rate (BuAc = 1): 2.2
Molecular Weight: N/A
Molecular Formula: N/A

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable

Conditions To Avoid: Heat; Contact with ignition sources

Materials To Avoid: Oxidizers
Strong mineral acids

Hazardous Decomposition: Carbon oxides

Hazardous Polymerization: Will not occur

SECTION 11 - TOXICOLOGICAL INFORMATION

See section 3 for specific toxicological information for the ingredients of this product.

SECTION 12 - ECOLOGICAL INFORMATION

By complying with sections 6 and 7 there will be no release to the environment.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

DOT	UN Number: UN1294	Shipping Class: 3	Packing Group: II	FLAMMABLE
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SECTION 15 - REGULATORY INFORMATION

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

Not all components are listed on the TSCA Inventory. For research and development use only. Not for manufacturing or commercial purposes.

WARNING: This product contains chemical(s) known to the state of California to cause cancer and to cause birth defects or other reproductive harm.

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

M A T E R I A L S A F E T Y D A T A S H E E T

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make

NO WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

* * * End of Document * * *

MATERIAL SAFETY DATA SHEET

MSDS Number
F-502S-0.1X

 **AccuStandard**
125 Market Street • New Haven, CT USA 06513
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number
203-786-5290
Mon. to Fri. 8am-5pm EDT

Product Number : F-502S-0.1X

Product Name : 2,3,4,7,8-Pentachlorodibenzofuran Solution.

Synonyms : N/A

Formula : N/A

Molecular Weight : N/A

Section 2 - Composition / Information on Ingredients

Component(s) (2)	CAS #	Appr. %	ACGIH TLV		OSHA PEL	
			TWA mg/m3	SKIN	TWA mg/m3	SKIN
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	0.0005%				
Toluene	108-88-3	99.99%	375		188 X	

Section 3 - Hazards Identification

Symptoms of Exposure:

HARMFUL OR FATAL IF SWALLOWED.

HARMFUL IF INHALED.

Symptoms: headache, dizziness, hallucinations, distorted perceptions, changes in motor activity, nausea, respiratory irritation, central nervous system depression and unconsciousness as well as liver, kidney and lung damage.

May Cause Damage To Liver, Kidneys, and Respiratory System.

Causes severe eye irritation.

MAY CAUSE SKIN IRRITATION.

Potential Health Effects:

May Cause Damage To Liver, Kidneys, and Respiratory System.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

Section 4 - First Aid Measures

First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Skin: Immediately flush thoroughly with large amounts of water.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: Call a physician immediately. ONLY induce vomiting at the instructions of a physician. Never give anything by mouth to an unconscious person.

Section 5 - Fire Fighting Measures

Fire fighting measures for the Solvent

Flammable Properties:

Flash Point (°F): 40F (tcc)

Flammable Limits LEL (%): 1.30

Flammable Limits UEL (%): 7.10

Dangerous fire and explosive hazard.

Vapor can travel distances to ignition source and flash back.

Extinguishing Media:

Use dry chemical, foam, or CO2.

Water spray to cool fire-exposed containers.

Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

Section 6 - Accidental Release Measures

Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

Section 7 - Handling and Storage

Keep container tightly closed.

Store in a cool area away from ignition sources and oxidizers.

Do not breath vapor or mist.

Do not get in eyes, on skin, or on clothing.

Electrically ground all equipment when handling this product.

Section 8 - Exposure Controls / Personal Protection

Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves should be worn to prevent skin contact.

(Viton or equivalent)

Safety glasses with side shields should be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

Section 9 - Physical and Chemical Properties

Physical and chemical properties for the Solvent

Appearance: Clear liquid, aromatic odor
Boiling Point: 111
Melting Point: -95
Specific Gravity (Water = 1): 0.87
Vapor Pressure: 21.9 20C
Vapor Density (Air = 1): 3.2
Percent Volatile (by volume): 99+ %
Evaporation Rate (Butyl acetate = 1): 2.2
Flash Point: 40F (tcc)
Explosion Limits (%): 1.30 to 7.10
Solubility in water (%): Insoluble

Section 10 - Stability and Reactivity

Stability: Stable

Materials to Avoid: Oxidizers
Other

Strong mineral acids

Hazardous Decomposition: CO>>x<< Hydrocarbons

Hazardous Polymerization: Does not occur

Conditions to Avoid: Heat; contact with ignition sources

Section 11 - Toxicological Information

See section 3 for specific toxicological information for the ingredients of this product.

Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

Section 14 - Transport Information

DOT Shipping Class: 3 Packing Group: II UN Number: UN1294

Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

Toluene is listed by the State of California as being known to the state to cause reproductive toxicity.

Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

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Close

Material Safety Data Sheet

ULTRA Scientific · 250 Smith Street · North Kingstown, RI, USA 02852 · 401-294-9400

Product # RPE-037

Last Updated: 11/14/2006

Section I Product Identification

Name: 2,3,7,8-Tetrachlorodibenzofuran

Matrix: neat compound

Section II Composition / Information on Ingredients

Component	CAS #	% by Wt.	LD50	OSHA PEL	ACGIH TLV	RTECS #	Codes
2,3,7,8-tetrachlorodibenzofuran	051207-31-9	100	N/A	N/A	N/A	N/A	G

Codes: A-OSHA regulated carcinogen; B-IARC Group 1 carcinogen; C-IARC Group 2A carcinogen; D-IARC Group 2B carcinogen; E-NTP Group 1 carcinogen; F-NTP Group 2 carcinogen; G-SARA Title III compound; H-California Proposition 65 compound.

Section III Hazards Identification

Contains carcinogen(s) or cancer suspect agent(s)

Toxic

All chemicals should be considered hazardous - direct physical contact should be avoided.

Section IV First Aid Measures

Inhalation: If inhaled, remove to fresh air. Give oxygen, if necessary. Contact a physician.

Skin Contact: In case of skin contact, flush with copious amounts of water. Remove contaminated clothing. Contact a physician.

Eye Contact: In case of eye contact, flush with copious amounts of water, lifting eyelids occasionally. Contact a physician.

Ingestion: If ingested, contact poison center immediately for recommended procedure. Contact a physician.

Section V Fire Fighting Measures

Fire and Explosion Hazard Data for Compound

Fire Hazard: N/A

Extinguishing Media: Carbon dioxide, dry chemical powder, or water spray.

Section VI Accidental Release Measures

Ventilate area of the leak or spill. Wear appropriate personal protective equipment as specified in Section VIII. A leaking bottle, vial, or ampule may be placed in a plastic bag, and normal disposal procedures followed. Take up spilled material with sand or other non-combustible absorbant material, and place in an appropriate container for later disposal. Flush spill area with water.

Section VII Handling and Storage

May be stored at room temperature

Keep in a tightly closed container, and store in a corrosion proof area.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

Section VIII Exposure Controls / Personal Protection

Ensure that there is adequate ventilation to prevent airborne levels from exceeding recommended exposure limits (see Section II). Use appropriate MSHA/NIOSH approved safety equipment. Wear chemical goggles, face shield, gloves, and chemical resistant clothing, such as a laboratory coat and/or a rubber apron, to prevent contact with eyes, skin, and clothing.

Section IX Physical and Chemical Properties

Physical Data for Compound

Melting Pt.: N/A

Boiling Pt.: N/A

Density: N/A

Vapor Pressure: N/A

Vapor Density: N/A

Water Solubility: N/A

Appearance: N/A

Odor: N/A

Flash Point: N/A

Auto-Ignition Temperature: N/A

LEL: N/A

UEL: N/A

Section X Stability and Reactivity

Reactivity Data for Compound

Stability: stable

Incompatibilities: N/A

Hazardous Decomposition Products: N/A

Hazardous Effects of Polymerization: no

Section XI Toxicological Information

See Section II for specific toxicological information for the ingredients of this product.

Section XII Ecological Information

No information is available.

Section XIII Disposal Considerations

Recycle, if possible. Any material which cannot be saved for recovery or recycling should be disposed of at an appropriate and approved waste disposal facility. Processing, use, and/or contamination of this product may change waste management requirements. Observe all applicable federal, state, and local environmental regulations concerning disposal.

Section XIV Transport Information

Shipment Type: Dangerous Goods in Excepted Quantity (US DOT Small Quantity Exemption)

UN Number: UN3316

Shipping Class: 9

Packing Group: N/A

Section XV Regulatory Information

No information is available.

Section XVI *Other Information*

The above information is believed to be correct, but does not purport to be all-inclusive. This data should be used only as a guide in handling this material. ULTRA Scientific, Inc., shall not be held liable for any damage resulting from handling or from contact with the above product.

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SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Manufacturer: AccuStandard, Inc.
125 Market Street
New Haven, CT 06513

Date MSDS Printed: 3/15/2006
Preparation Date: 3/15/2006
Information Phone Number: 203-786-5290
Emergency Phone Number: 203-786-5290
Hours: Mon. to Fri. 8am-5pm EDT

MSDS Number: D-404N

Product Name: 2,3,7,8-Tetrachlorodibenzo-p-dioxin

Synonyms: 2,3,7,8-Tetrachlorodibenzo-p-dioxin; TCDD; TCDBD; Tetradoxin; Dioxin

Formula: $C_{12}H_4Cl_4O_2$

Molecular Weight: 321.96

SECTION 2 - COMPOSITION / INFORMATION ON INGREDIENTS

Component(s) (1)	CAS #	Appr. %	ACGIH-TLV (mg/m3)		OSHA-PEL (mg/m3)	
			TWA	STEL skin	TWA	STEL skin
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	100				

SECTION 3 - HAZARDS IDENTIFICATION**Symptoms of Exposure:**

Irritating to eyes, mucous membranes and upper respiratory system.

Causes skin redness and irritation. Repeated or prolonged exposure may cause dermatitis.

May cause stomach cramps and gastro-intestinal disturbances.

Possible reproductive and teratogenic hazard.

Potential Health Effects:

Considered HIGHLY TOXIC.

May be fatal if inhaled, absorbed through skin, or swallowed.

May cause eye, kidney, liver, and skin damage.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

This product is or contains a component that is classified (ACGIH, IARC, NTP, OSHA) as a cancer hazard.

SECTION 4 - FIRST AID MEASURES**Emergency First Aid:**

Get medical assistance for all cases of overexposure.

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

Ingestion: Drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

SECTION 5 - FIRE FIGHTING MEASURES

Flammable Properties:

Flash Point: N/A

Flammable Limits LEL (%): N/A

Flammable Limits UEL (%): N/A

Autoignition Temperature: N/A

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

Fire Fighting Procedures:

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Spill Response:

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container.

Store in a cool area away from ignition sources and oxidizers.

Do not breathe dust.

Do not get in eyes, on skin or clothing.

Avoid prolonged or repeated exposure.

This product should only be used by persons trained in the safe handling of hazardous chemicals.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls and Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material must be handled or transferred in an approved fume hood or with equivalent ventilation.

Compatible chemical-resistant protective gloves must be worn to prevent skin contact.

Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colorless to white crystalline solid

Odor: N/A

pH: N/A

Vapor Pressure: Negligible

Vapor Density (Air = 1): N/A

Boiling Point: Decomposes (750 - 800 °C)

Melting Point: 305 °C (581 °F)

Solubility in Water (%): Insoluble

Specific Gravity (H₂O = 1): 1.8 g/cm³

Flash Point: N/A

Explosion Limits (%): N/A to N/A

Autoignition Temperature: N/A

Percent Volatile: N/A

Evaporation Rate (BuAc = 1): N/A

Molecular Weight: 321.96

Molecular Formula: C₁₂H₄Cl₄O₂

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable

Conditions To Avoid: Light

Materials To Avoid: Oxidizers

Hazardous Decomposition: Carbon oxides; Produces chlorine on exposure to light

Hazardous Polymerization: Will not occur

SECTION 11 - TOXICOLOGICAL INFORMATION

See section 3 for specific toxicological information for the ingredients of this product.

SECTION 12 - ECOLOGICAL INFORMATION

By complying with sections 6 and 7 there will be no release to the environment.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

DOT	UN Number: UN2811	Shipping Class: 6.1	Packing Group: I	VERY TOXIC
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SECTION 15 - REGULATORY INFORMATION

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

WARNING: This product contains chemical(s) known to the state of California to cause cancer and to cause birth defects or other reproductive harm.

The CAS number of this product is NOT listed on the TSCA Inventory. For reasearch and development use only. Not for manufacturing or commercial purposes.

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make
NO WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

* * * End of Document * * *




**ALDON
CORPORATION**

221 Rochester Street
Avon, New York 14414-9409
(585) 226-6177

MSDS No.: AA0135 AA0143 AA0144
Effective Date: AA0145 AA0146 AA0147
January 1, 2007

MATERIAL SAFETY DATA SHEET

SECTION I NAME 24 HOUR EMERGENCY ASSISTANCE

Product	Aluminum Metal	 CHEMTREC 800-424-9300 Day 585-226-6177 NFPA HAZARD RATING MINIMAL SLIGHT MODERATE SERIOUS SEVERE 0 1 2 3 4	Health	0
Chemical Synonyms	Granular, Shot, Sheet, Strips, Turnings		Fire	1
Formula	Al		Reactivity	1
Unit Size	up to 2.5 Kg.		HMIS *	
C.A.S. No.	7429-90-5			

SECTION II INGREDIENTS OF MIXTURES

Principal Component(s)	%	TLV Units
Aluminum metal	>99.5	See Section V.
CAUTION! INHALATION AS DUST OR FUME MAY CAUSE IRRITATION.		

SECTION III PHYSICAL DATA

Melting Point (°F)	660°C (1220°F)	Specific Gravity (H ₂ O = 1)	N/A
Boiling Point (°F)	N/A	Percent Volatile by Volume (%)	N/A
Vapor Pressure (mm Hg)	N/A	Evaporation Rate (=1)	N/A
Vapor Density (Air=1)	0.095 - 0.113 lb/in ³		
Solubility in Water	Insoluble.		
Appearance & Odor	Silver gray colored metal, granular, shot, sheet, strips, turnings. No odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	N/A	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Extinguisher Media	Halogenated extinguishing agents should not be used. To control the spread of fire, do not use water. Ring small fire with sand, eliminate drafts, let fire extinguish itself.				

SPECIAL FIREFIGHTING PROCEDURES

In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Dust clouds may be explosive. Prevent formation of a dust cloud. Bulk dust when damp may heat spontaneously. Hazard greater as fineness increases. Reacts with some acids and caustic solutions to produce hydrogen. Molten aluminum may explode on contact with water. It may also react violently with rust, certain metal oxides (e.g. oxides of copper, iron and lead) and nitrates (e.g. ammonium nitrate and fertilizers containing ammonium nitrate).

D.O.T. Non Regulated.

Approved by U.S. Department of Labor "essentially similar" to form OSHA-20

SECTION V HEALTH HAZARD DATA AA0135

Threshold Limited Value	TWA: 10 mg/m ³ (ACGIH 2001) as aluminum metal dust.
Effects of Overexposure	INGESTION: May cause irritation. Exercise appropriate procedures to minimize potential hazards. EYES: Particles of aluminum in the eye may cause injury to the cornea. INHALATION: It has been reported in the literature that chronic exposure to aluminum dust has been suspected of causing lung injury. Target organs: None known.

Emergency and First Aid Procedures	INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person. EYES: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention. SKIN: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention. INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
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SECTION VI REACTIVITY DATA

Stability	Unstable	Conditions to Avoid	Heat, spark, flame, water and strong oxidizing agents.
	Stable	X	

Incompatibility (Materials to Avoid)	Strong oxidizers, acids, alkalies, halogenated compounds, heat and water.
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Hazardous Decomposition Products		Aluminum reacts with water, acids or alkalies to generate hydrogen.
Hazardous Polymerization		Conditions to Avoid
May Occur	Will Not Occur	Not applicable.
	X	

SECTION VII SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled	Recover when possible. Sweep material onto paper. Place in a fiber carton. Wash spill area well with soap and water.
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Waste Disposal Method	Discharge, treatment, or disposal may be subject to Federal, State or Local laws. These disposal guidelines are intended for the disposal of catalog-size quantities only.
	Dispose of in accordance with federal, state and local regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

Respiration Protection (Specify Type)	None needed in normal laboratory handling. If dusty conditions prevail, wear a NIOSH/MSHA-approved dust mask or work in ventilation hood.			
Ventilation	Local Exhaust	Recommended.	Special	No.
	Mechanical (General)	Recommended.	Other	No.
Protective Gloves	Rubber.		Eye Protection	Chemical safety glasses.

Other Protective Equipment	Goggles, safety glasses, lab coat, fire extinguisher, eye wash station.
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SECTION IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling & Storing	Store in a dry place away from acids, alkalies and oxidizers. Dangerous when wet, take precautions. Wash thoroughly after handling.
Keep container tightly closed when not in use.	

Other Precautions	Read label on container before using. Do not wear contact lenses when working with chemicals. For laboratory use only. Not for drug, food or household use. Keep out of reach of children.
	Sheets and/or strips have sharp edges. Use caution when handling. Remove and wash contaminated clothing.

Revision No.	12	Date	01/01/07	Approved	James A. Bertsch	Chemical Safety Coordinator	JAB
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The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. * Hazardous Materials Industrial Standards. Printed on recycled paper.



MATERIAL SAFETY DATA SHEET

5100 W. Henrietta Rd.
West Henrietta, NY 14586
TEL: (866) 260-0501

MSDS No. 9500302
Effective Date: December 1, 2005

SECTION I NAME 24 HOUR EMERGENCY ASSISTANCE

Product	Barium Metal	416-984-3000 NFPA HAZARD RATING Minimal 0 Slight 1 Moderate 2 WHMIS Serious 3 Severe 4
Chemical Synonyms	Barium	
Formula	Ba	
CAS No.	7440-39-3	

SECTION II DANGEROUS INGREDIENTS

Name	%	TLV Units
Barium metal - Immersed in mineral oil	100%	N/A
DANGER! FLAMMABLE SOLID! DANGEROUS WHEN WET!		

SECTION III PHYSICAL DATA

Melting Point (°C)	850°C	Specific Gravity (H ₂ O = 1)	3.74
Boiling Point (°C)	1695°C	Percent Volatile by Volume (%)	N/A
Vapor Pressure (mm Hg)	N/A	Evaporation Rate (=1)	N/A
Vapor Density (Air=1)	N/A		
Solubility in Water	Reacts violently with water. Produces extremely flammable gases.		
Appearance & Odor	Soft, silvery, lustrous metal immersed in heavy mineral oil; no odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash point	Flammable solid.	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Firefighting Procedures					

DO NOT USE WATER. Use dry sand, earth, dolomite or sodium chloride. In fire conditions, fire-fighters should wear an appropriate mask or a self-containing breathing apparatus.

Flammability and Explosion Hazards

Reaction with water produces explosive hydrogen gas and enough heat to ignite gas/air mixture plus toxic, corrosive Barium hydroxide solution.

TDG Class 4.3 Material that emits flammable gases on contact with water. UN2813

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SECTION V

REACTIVITY DATA

BB0003

Chemical Stability	Yes	X	<u>If no. under what conditions?</u>
	No		
Incompatible with Other products	Yes	X	Water, acids, oxidizers, chlorinated and fluorinated hydrocarbons such as CCl4.
	No		
Hazardous Decomposition Products	Hydrogen (explosive), barium hydroxide solution (caustic/toxic).		
Reactive under what conditions	Reacts violently with water, the humidity in moist air and moisture in other substances, releasing explosive hydrogen gas.		

SECTION VI

TOXICOLOGICAL PROPERTIES

Route of Entry	Inhalation. Ingestion. Eyes. Skin.
TLV	Barium and soluble compounds, as Ba ACGIH 2001: TWA: 0.5 mg/m ³ .
Toxicity for animals	Not available.
Chronic effects on humans	Repeated or prolonged exposure to the substance can produce target organ damage. Target organs: Central nervous system, kidneys.
Acute effects on humans	Contact causes severe burns to the skin and eyes. May cause blindness.

SECTION VII

PREVENTIVE MEASURES

Waste Disposal	Discharge, treatment, or disposal may be subject to local laws. Consult your local or regional authorities.
Storage	Keep container in a cool, well ventilated place. Keep away from heat. Keep away from incompatible materials. Keep away from sources of ignition and open flames. Keep baryum metal immersed in mineral oil or argon.
Precautions	Avoid contact with skin and eyes. Do not ingest. If ingested, seek immediate medical attention.
Spill or leak	To prevent ignition, coat with mineral oil, soaking thoroughly and place in oiled steel container and secure tightly. Keep away from water, rain, snow, etc. Wash spill area with soap and water.
Protective Clothing	Gloves, safety glasses, lab coat, dust respirator.

SECTION VIII

FIRST AID MEASURES

Specific first aid measures	Ingestion: Call physician or Poison Control Center immediately. Induce vomiting only if advised by the appropriate medical personnel. Eye contact: Check for and remove any contact lenses. Do NOT flush with water. Carefully remove particles with cotton-tipped applicator. Seek immediate medical attention. Skin contact: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Inhalation: Move victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Allow victim to rest in a well ventilated area. Seek immediate medical attention.
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SECTION IX


PREPARATION OF THE MSDS

Rev. No.	1	Date	December 1, 2005	Approved	Michael Raszeja
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MATERIAL SAFETY DATA SHEET

MSDS No. 9409804 9409904
Effective Date: February 16, 2007

SECTION I NAME 24 HOUR EMERGENCY ASSISTANCE

Product	Chromium Metal	CHEMTREC 1-800-424-9300  NFPA HAZARD RATING Minimal Slight Moderate Serious Severe 0 1 2 3 4 WHMIS	Health	0
Chemical Synonyms	Chromium; Chrome		Flammability	0
Formula	Cr		Reactivity	0
CAS No.	7440-47-3			

SECTION II DANGEROUS INGREDIENTS

Name	%	TLV Units
Chromium metal	100%	TWA: 0.5 mg/m ³
CAUTION!		

SECTION III PHYSICAL DATA

Melting Point (°C)	1830°C	Specific Gravity (H ₂ O = 1)	7.20 @ 20°C
Boiling Point (°C)	2200°C	Percent Volatile by Volume (%)	N/A
Vapor Pressure (mm Hg)	N/A	Evaporation Rate (=1)	N/A
Vapor Density (Air=1)	N/A		
Solubility in Water	Insoluble.		
Appearance & Odor	Steel-grey pieces or granules; no odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash point	Not flammable.	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Firefighting Procedures	Use dry chemical, CO ₂ , alcohol foam, or water spray. In fire conditions, fire-fighters should wear an appropriate mask or a self-containing breathing apparatus.				

Flammability and Explosion Hazards

Negligible fire hazard in metallic form; however, possible fire and explosion hazard in dust form when exposed to heat or flame.

Auto-ignition temperature: 400°C as dust.

TDG Not a TDG controlled material.

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. For laboratory use only. Not for drug, food or household use. Keep out of reach of children. Printed on recycled paper.

SECTION V REACTIVITY DATA

CC0285

Chemical Stability	Yes	X	If no., under what conditions?
	No		
Incompatible with Other products	Yes	X	Attacked by caustic alkalis and alkali carbonates, acids, strong oxidizers.
	No		

Hazardous Decomposition Products	Chromium fumes.
Reactive under what conditions	Not applicable.

SECTION VI TOXICOLOGICAL PROPERTIES

Route of Entry	Inhalation. Ingestion.
TLV	TWA: 0.5 mg/m ³ as Cr and inorganic compounds
Toxicity for animals	Not available.
Chronic effects on humans	WARNING: THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER. Suspect cancer hazard. Repeated or prolonged exposure to the substance can produce target organ damage. Risk of cancer depends on level and duration of exposure. Target organs: Lungs, kidneys.

Acute effects on humans	May be harmful if inhaled or swallowed. Contact may cause irritation to the skin and eyes.
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SECTION VII PREVENTIVE MEASURES

Waste Disposal	Discharge, treatment, or disposal may be subject to local laws. Consult your local or regional authorities.
Storage	Keep container in a cool, well ventilated place. Keep away from heat. Keep away from incompatible materials. Keep away from sources of ignition and open flames.
Precautions	Avoid contact with skin and eyes. Do not breathe dust. Use with adequate ventilation. Do not ingest. If ingested, seek immediate medical attention.
Spill or leak	Use appropriate tools to put the spilled solid in a convenient waste disposal container. Wash spill area with soap and water.
Protective Clothing	Gloves, safety glasses, lab coat, dust respirator.

SECTION VIII FIRST AID MEASURES

Specific first aid measures	Ingestion: Call physician or Poison Control Center immediately. Induce vomiting only if advised by the appropriate medical personnel. Eye contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Seek medical attention. Skin contact: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Inhalation: Move victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Allow victim to rest in a well ventilated area. Seek immediate medical attention.
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SECTION IX PREPARATION OF THE MSDS

Rev. No.	3	Date	February 16, 2007	Approved	James A. Bertsch
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GARDENA, CA
NEW BRUNSWICK, NJ

Material Safety Data Sheet

NFPA	HMIS	Personal Protective Equipment						
	<table><tr><td>Health Hazard</td><td>1</td></tr><tr><td>Fire Hazard</td><td>0</td></tr><tr><td>Reactivity</td><td>0</td></tr></table>	Health Hazard	1	Fire Hazard	0	Reactivity	0	 See Section 15.
Health Hazard	1							
Fire Hazard	0							
Reactivity	0							

Section 1. Chemical Product and Company Identification

Page Number: 1

Common Name/ Trade Name	Iron Metal	Catalog Number(s).	I1197, I1030, I1041, I1042
Manufacturer	SPECTRUM LABORATORY PRODUCTS INC. 14422 S. SAN PEDRO STREET GARDENA, CA 90248	CAS#	7439-89-6
Commercial Name(s)	Not available.	RTECS	NO4565500
Synonym	Iron metal filings; Iron Metal Wire; Iron Metal Wire, 0.25mm; Iron metal granular	TSCA	TSCA 8(b) inventory: Iron Metal
Chemical Name	Iron	CI#	Not applicable.
Chemical Family	Inert material.	IN CASE OF EMERGENCY CHEMTREC (24hr) 800-424-9300 CALL (310) 516-8000	
Chemical Formula	Fe		
Supplier	SPECTRUM LABORATORY PRODUCTS INC. 14422 S. SAN PEDRO STREET GARDENA, CA 90248		

Section 2. Composition and Information on Ingredients

		Exposure Limits			
Name	CAS #	TWA (mg/m ³)	STEL (mg/m ³)	CEIL (mg/m ³)	% by Weight
1) Iron Metal	7439-89-6				100

Toxicological Data
on Ingredients

Not applicable.

Section 3. Hazards Identification

Potential Acute Health Effects	Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion. Non-hazardous in case of inhalation.
Potential Chronic Health Effects	CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to liver, cardiovascular system, upper respiratory tract, pancreas. Repeated or prolonged exposure to the substance can produce target organs damage.

Continued on Next Page

Section 4. First Aid Measures

Eye Contact	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin Contact	Wash with soap and water. Get medical attention if irritation develops.
Serious Skin Contact	Not available.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Serious Inhalation	Not available.
Ingestion	Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.
Serious Ingestion	Not available.

Section 5. Fire and Explosion Data

Flammability of the Product	Non-flammable.
Auto-Ignition Temperature	Not available.
Flash Points	Not available.
Flammable Limits	Not available.
Products of Combustion	Some metallic oxides.
Fire Hazards in Presence of Various Substances	Not applicable.
Explosion Hazards in Presence of Various Substances	Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.
Fire Fighting Media and Instructions	Not applicable.
Special Remarks on Fire Hazards	Chlorine Trifluoride reacts with iron with incandescence. Powdered iron reacts with fluorine below redness with incandescence. Reduced iron decomposes with nitrogen dioxide @ ordinary temperature with incandescence. Reacting mass formed by mixture of phosphorus and iron can become incandescent when heated. This material is flammable in powder form only.
Special Remarks on Explosion Hazards	Material in powdered form can explode when exposed to heat or flame

Section 6. Accidental Release Measures

Small Spill	Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.
Large Spill	Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7. Handling and Storage

Precautions	Do not ingest. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area. Moisture sensitive.

Section 8. Exposure Controls/Personal Protection

Engineering Controls	Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.
Personal Protection	Safety glasses. Lab coat. Gloves.
Personal Protection in Case of a Large Spill	Goggles. Boots. Gloves.
Exposure Limits	Not available.

Section 9. Physical and Chemical Properties

Physical state and appearance	Solid. (Metal solid.)	Odor	Odorless.
Molecular Weight	55.85 g/mole	Taste	Tasteless.
pH (1% soln/water)	Not applicable.	Color	Silver-white Grey.
Boiling Point	3000°C (5432°F)		
Melting Point	1535°C (2795°F)		
Critical Temperature	Not available.		
Specific Gravity	Density: 7.86 (Water = 1)		
Vapor Pressure	Not applicable.		
Vapor Density	Not available.		
Volatility	Not available.		
Odor Threshold	Not available.		
Water/Oil Dist. Coeff.	Not available.		
Ionicity (in Water)	Not available.		
Dispersion Properties	Not available.		
Solubility	Insoluble in cold water, hot water, diethyl ether. Insoluble in alcohol, alkali. Soluble in acids.		

Section 10. Stability and Reactivity Data

Stability	The product is stable.
Instability Temperature	Not available.
Conditions of Instability	Excess heat, incompatible materials, water/moisture, air
Incompatibility with various substances	Reactive with oxidizing agents, acids.
Corrosivity	Not considered to be corrosive for metals and glass.

Continued on Next Page

Special Remarks on Reactivity

Hot iron(wire) burns in Chlorine gas
 Violent decomposition of hydrogen peroxide (53% by weight or greater) may be caused by contact with iron.
 Readily oxidizes in moist air forming rust.
 Reactive with halogens
 Incompatible with acetaldehyde, ammonium peroxodisulfate, chloroformamidine, chloric acid, ammonium nitrate, dinitrogen tetroxide, nitril fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, sulfuric acid, sodium carbide.
 Readily attacked by dilute mineral acids and or attacked or dissolved by organic acids.
 Not appreciably attacked by cold sulfuric acid, or nitric acid, but is attacked by hot acids

Special Remarks on Corrosivity

Not available.

Polymerization

Will not occur.

Section 11. Toxicological Information**Routes of Entry**

Inhalation. Ingestion.

Toxicity to Animals

Acute oral toxicity (LD50): 30000 mg/kg [Rat].

Chronic Effects on Humans

May cause damage to the following organs: liver, cardiovascular system, upper respiratory tract, pancreas.

Other Toxic Effects on Humans

Slightly hazardous in case of skin contact (irritant), of ingestion.
 Non-hazardous in case of inhalation.

Special Remarks on Toxicity to Animals

Not available.

Special Remarks on Chronic Effects on Humans

Not available.

Special Remarks on other Toxic Effects on Humans

Acute Potential Health Effects:
 Skin:
 Iron metal filings, granular, or dust: May cause skin irritation by mechanical action.
 Iron metal wire: Not likely to cause skin irritation
 Eyes:
 Iron metal filings, granular, or dust: Can irritate eyes by mechanical action.
 Iron metal wire: No hazard. Will not cause eye irritation.
 Inhalation:
 Iron dust: Can irritate the respiratory tract by mechanical action.
 Iron metal wire, granular, or filings: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count.
 Ingestion:
 Iron metal wire: Not an ingestion hazard:
 Iron metal filings, granular, or dust: The amount of ingested iron which constitutes a toxic dose is not well defined. Proposed toxic doses of elemental iron are 20 mg/kg for gastrointestinal irritation to greater than 60 mg/kg for systemic toxicity.
 Gastrointestinal effects are the first signs to appear, with hemorrhagic vomiting and diarrhea, hematochezia, abdominal pain, lethargy, metabolic acidosis, coagulopathy, shock, coma and convulsions developing from 0 to 6 hours after ingestion. Leukocytosis may also occur. An asymptomatic phase may ensue at 6 to 12 hours post-ingestion, followed by hypoglycemia or hyperglycemia, hepatic and renal failure, severe acidosis, cyanosis, fever, CNS depression (lethargy, restlessness and/or confusion seizures), hypotension, and cardiovascular collapse/cardiac failure in 12 to 48 hours. Hepatic cirrhosis, gastrointestinal scarring and/or strictures may arise in 2 to 6 weeks. It may also cause an anaphylactoid reaction. Non-cardiogenic pulmonary edema also develop in severe cases of iron intoxication.
 Chronic Potential Health Effects:
 Inhalation: Chronic inhalation of iron dust can lead to accumulation in the lungs and a characteristic stippled appearance on X-rays. This condition, called SIDEROSIS, is considered benign in that it does not interfere with lung function and does not predispose to other disease. Chronic inhalation of iron dust may also cause fibrosis in the lungs.
 Ingestion: Clinical signs of iron overload appear when the total body iron is 5 to 10 times higher than normal. Neurobehavioral defects including depression, decreased activity, habituation, reflex startle, and conditioned avoidance response performance may occur. However, similar effects were also seen in iron deficiency. It is therefore likely that these behavioral effects are secondary to general toxicity. High serum iron levels may be associated with an increased risk of fatal acute myocardial infarction (MI).
 Skin: Prolonged or repeated contact may cause hypersensitivity.


Section 12. Ecological Information

Ecotoxicity	Not available.
BOD5 and COD	Not available.
Products of Biodegradation	Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
Toxicity of the Products of Biodegradation	The product itself and its products of degradation are not toxic.
Special Remarks on the Products of Biodegradation	Not available.

Section 13. Disposal Considerations

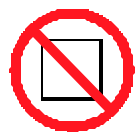
Waste Disposal	Waste must be disposed of in accordance with federal, state and local environmental control regulations.
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Section 14. Transport Information

DOT Classification	Not a DOT controlled material (United States).
Identification	Not applicable.
Special Provisions for Transport	Not applicable.
DOT (Pictograms)	

Section 15. Other Regulatory Information and Pictograms

Federal and State Regulations	California Director's List of Hazardous Substances: Iron Metal TSCA 8(b) inventory: Iron Metal																
California Proposition 65 Warnings	California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: No products were found. California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: No products were found.																
Other Regulations	EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.																
Other Classifications	WHMIS (Canada)	Not controlled under WHMIS (Canada).															
	DSCL (EEC)	This product is not classified according to the EU regulations.	Not applicable.														
HMS (U.S.A.)	<table><tr><td>Health Hazard</td><td>1</td></tr><tr><td>Fire Hazard</td><td>0</td></tr><tr><td>Reactivity</td><td>0</td></tr><tr><td>Personal Protection</td><td>B</td></tr></table>	Health Hazard	1	Fire Hazard	0	Reactivity	0	Personal Protection	B	National Fire Protection Association (U.S.A.)	<table><tr><td>Flammability</td><td>0</td></tr><tr><td>Reactivity</td><td>0</td></tr><tr><td>Specific hazard</td><td></td></tr></table>	Flammability	0	Reactivity	0	Specific hazard	
Health Hazard	1																
Fire Hazard	0																
Reactivity	0																
Personal Protection	B																
Flammability	0																
Reactivity	0																
Specific hazard																	

WHMIS (Canada)
(Pictograms)DSCL (Europe)
(Pictograms)TDG (Canada)
(Pictograms)ADR (Europe)
(Pictograms)

Protective Equipment



Gloves



Lab coat.



Safety glasses.

Section 16. Other Information

MSDS Code I3240

References Not available.

Other Special
Considerations Not available.

Validated by Sonia Owen on 11/17/2008.

Verified by Sonia Owen.

Printed 12/2/2008.

CALL (310) 516-8000

Notice to Reader

All chemicals may pose unknown hazards and should be used with caution. This Material Safety Data Sheet (MSDS) applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this MSDS. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this MSDS is based on technical data judged to be reliable, Spectrum Quality Products, Inc. assumes no responsibility for the completeness or accuracy of the information contained herein.




**ALDON
CORPORATION**

MATERIAL SAFETY DATA SHEET

221 Rochester Street
Avon, New York 14414-9409
(585) 226-6177

LL0070 LL0077
LL0079 LL0080 LL0081
MSDS No.: LL0082 LL0085 LL0086
Effective Date: January 12, 2007

SECTION I NAME 24 HOUR EMERGENCY ASSISTANCE

Product	Lead Metal	 CHEMTREC 800-424-9300 Day 585-226-6177 NFPA HAZARD RATING MINIMAL SLIGHT MODERATE SERIOUS SEVERE 0 1 2 3 4 HMIS*	Health	3
Chemical Synonyms	N/A		Fire	0
Formula	Pb		Reactivity	0
Unit Size	up to 2.5 Kg.			
C.A.S. No.	7439-92-1			

SECTION II INGREDIENTS OF MIXTURES

Principal Component(s)	%	TLV Units
Lead metal, shot, granular, sheet, foil	99+%	See Section V.
CAUTION!		

MAY BE HARMFUL OR FATAL IF SWALLOWED OR INHALED AS FUMES OR DUST.

SECTION III PHYSICAL DATA

Melting Point (°F)	Approx. 327.4°C (621°F)	Specific Gravity (H ₂ O = 1)	11.34 (20/4°C)
Boiling Point (°F)	1753°C (3187°F)	Percent Volatile by Volume (%)	0% at ambient temp.
Vapor Pressure (mm Hg)	N/A	Evaporation Rate (=1)	Non-volatile (N/A).
Vapor Density (Air=1)	N/A		
Solubility in Water	Insoluble.		
Appearance & Odor	Bluish, silvery, gray soft metal, granular, shot, sheet, foil; no odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	Non-flammable.	Flammable Limits in Air % by Volume	N/A	Lower	Upper
				-----	-----
Extinguisher Media	Dry chemical or carbon dioxide should be used on surrounding fire. Do not use water on fires where molten metal is present.				

SPECIAL FIREFIGHTING PROCEDURES

In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARDS

When heated emits toxic fumes of lead which can react vigorously with oxidizing materials.

SECTION V HEALTH HAZARD DATA LL0070

Threshold Limited Value	Lead as inorganic compounds, as Pb: TWA 0.05 mg/m ³ (ACGIH 2001).
Effects of Overexposure	Suspect cancer hazard. SKIN: Not absorbed through skin. EYES: No specific hazard known. Contact may cause transient irritation. INGESTION: May produce anorexia, vomiting, malaise, convulsions due to increased intracranial pressure. INHALATION: Of dust or fumes can cause lead poisoning. Risk of cancer depends on level and duration of exposure. Target organs: Lungs, kidneys.

Emergency and First Aid Procedures	INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person. EYES: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention. SKIN: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention. INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
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SECTION VI REACTIVITY DATA

Stability	Unstable		Conditions to Avoid	High temperatures to produce fumes.
	Stable	X		
Incompatibility (Materials to Avoid)	Strong oxidizing materials.			

Hazardous Decomposition Products	When heated, emits toxic fumes of lead.		
Hazardous Polymerization	Conditions to Avoid		
May Occur	Will Not Occur	Not applicable.	
	X		

SECTION VII SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled	Carefully sweep up without producing dust and recycle for use or place in a suitable container for disposal.
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Waste Disposal Method	Discharge, treatment, or disposal may be subject to Federal, State or Local laws. These disposal guidelines are intended for the disposal of catalog-size quantities only. Dispose of in an approved chemical landfill or contract with a licensed waste disposal service.
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SECTION VIII SPECIAL PROTECTION INFORMATION

Respiration Protection (Specify Type)	None should be needed in normal laboratory use at room temperature. If dusty conditions prevail, work in ventilation hood or wear a NIOSH/MSHA-approved dust mask or respirator.			
Ventilation	Local Exhaust	None needed.	Special	No.
	Mechanical (General)	None needed.	Other	No.

Protective Gloves	Recommended - leather.	Eye Protection	Chemical safety glasses.
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Other Protective Equipment	Smock, apron, eye wash station, lab coat, ventilation hood.
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SECTION IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling & Storing	Store in a cool, dry place away from fire hazards. Wash thoroughly after handling. Remove and wash contaminated clothing.
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Other Precautions	Read label on container before using. Do not wear contact lenses when working with chemicals. For laboratory use only. Not for drug, food or household use. Keep out of reach of children. Lead can react violently with oxidizing materials. Water may become trapped within surface cracks which may cause an explosion when the metal is molten.
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WARNING: THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Revision No.	10	Date	01/12/07	Approved	James A. Bertsch	Chemical Safety Coordinator	JAB
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The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. * Hazardous Materials Industrial Standards. Printed on recycled paper.

D.O.T. Non Regulated.

Approved by U.S. Department of Labor "essentially similar" to form OSHA-20

MSDS # 426.20

Magnesium Metal



Section 1: Product and Company Identification

Magnesium Metal

Synonyms/General Names: N/A**Product Use:** For educational use only**Manufacturer:** Columbus Chemical Industries, Inc., Columbus, WI 53925.

24 Hour Emergency Information Telephone Numbers

CHEMTREC (USA): 800-424-9300**CANUTEC (Canada): 613-424-6666**

Scholar Chemistry; 5100 W. Henrietta Rd, Rochester, NY 14586; (866) 260-0501; www.Scholarchemistry.com

Section 2: Hazards Identification

*Silver metal chips, granules, ribbon, turnings, no odor***WARNING!** Flammable solid, dangerous when wet.

Flammable solid, keep away from all ignition sources. Contact with water produces flammable gas.

Target organs: Skin, eyes and respiratory system.

HMIS (0 to 4)

Health	1
Fire Hazard	2
Reactivity	2

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Section 3: Composition / Information on Ingredients

Magnesium (7439-95-4), >99%

Section 4: First Aid Measures

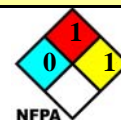
*Always seek professional medical attention after first aid measures are provided.***Eyes:** Immediately flush eyes with excess water for 15 minutes, lifting lower and upper eyelids occasionally.**Skin:** Immediately flush skin with excess water for 15 minutes while removing contaminated clothing.**Ingestion:** Call Poison Control immediately. Rinse mouth with cold water. Give victim 1-2 tbsp of activated charcoal mixed with 8 oz water.**Inhalation:** Remove to fresh air. If not breathing, give artificial respiration.

Section 5: Fire Fighting Measures

Flammable solid. When heated to decomposition, emits acrid fumes

Protective equipment and precautions for firefighters: Do Not Use carbon dioxide, foam, water or halogenated extinguishing agents. Use class D extinguisher or smother with dry sand, dry clay, dry ground limestone or dry graphite. Firefighters should wear full fire fighting turn-out gear and respiratory protection (SCBA).

Material is not sensitive to mechanical impact or static discharge.



Section 6: Accidental Release Measures

Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all ignition sources and ventilate area. Sweep up spill and place material in a dry container for disposal. See Section 13 for disposal information.

Section 7: Handling and Storage

Red**Handling:** Use with adequate ventilation and do not breathe dust or vapor. Avoid contact with skin, eyes, or clothing. Wash hands thoroughly after handling.**Storage:** Store in Flammable Area [Red Storage] with other flammable materials and away from any strong oxidizers. Store in a dedicated flammables cabinet. Store in a cool, dry, well-ventilated, locked store room away from incompatible materials.

Section 8: Exposure Controls / Personal Protection

Use ventilation to keep airborne concentrations below exposure limits. Have approved eyewash facility, safety shower, and fire extinguishers readily available. Wear chemical splash goggles and chemical resistant clothing such as gloves and aprons. Wash hands thoroughly after handling material and before eating or drinking. Use NIOSH-approved respirator with a dust cartridge.

Exposure guidelines: Magnesium: OSHA PEL: N/A and ACGIH TLV: N/A, STEL: N/A.

Section 9: Physical and Chemical Properties

Molecular formula	Mg.	Appearance	Silver metal chips, granules, or turnings.
Molecular weight	24.31.	Odor	No odor.
Specific Gravity	1.74 g/mL @ 20°C.	Odor Threshold	N/A.
Vapor Density (air=1)	N/A.	Solubility	Acids.
Melting Point	651°C.	Evaporation rate	N/A. (<i>Butyl acetate = 1</i>).
Boiling Point/Range	1107°C.	Partition Coefficient	N/A. (<i>log P_{OW}</i>).
Vapor Pressure (20°C)	N/A.	pH	N/A.
Flash Point:	N/A.	UEL	N/A.
Autoignition Temp.:	473°C (883°F).	LEL	N/A.

N/A = Not available or applicable

Section 10: Stability and Reactivity

Avoid heat and ignition sources

Stability: Stable under normal conditions of use.

Incompatibility: Water, acids, chlorine, iodine, bromine and oxidizing agents.

Shelf life: Indefinite if stored properly.

Section 11: Toxicology Information

Acute Symptoms/Signs of exposure: *Eyes:* Stinging pain, burns, watering of eyes, inflammation of eyelids and conjunctivitis. Avoid looking at burning magnesium. *Skin:* Irritation, redness, burns. Powdered metal ignites readily on skin causing burns. *Ingestion:* Nausea, vomiting and headache. *Inhalation:* Rapid irregular breathing, headache, burns to mucous membranes. Inhalation of dust or fumes causes metal fume fever.

Chronic Effects: Repeated/prolonged skin contact may cause dryness or rashes.

Sensitization: none expected

Magnesium: LD50 [oral, rat]; Not Available; LC50 [rat]; Not Available; LD50 Dermal [rabbit]; Not Available

Material has not been found to be a carcinogen nor produce genetic, reproductive, or developmental effects.

Section 12: Ecological Information

Ecotoxicity (aquatic and terrestrial):

Ecological impact has not been determined

Section 13: Disposal Considerations

Check with all applicable local, regional, and national laws and regulations. Local regulations may be more stringent than regional or national regulations. Use a licensed chemical waste disposal firm for proper disposal.

Section 14: Transport Information

DOT Shipping Name:	Magnesium.	Canada TDG:	Magnesium.
DOT Hazard Class:	4.1, pg III.	Hazard Class:	4.1, pg III.
Identification Number:	UN1869.	UN Number:	UN1869.

Section 15: Regulatory Information

EINECS: Listed (231-104-6).

TSCA: All components are listed or are exempt.

WHMIS Canada: B4, B6: Flammable solid, Reactive flammable material.

California Proposition 65: Not listed.

The product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Section 16: Other Information

Current Issue Date: January 23, 2009

Disclaimer: Scholar Chemistry and Columbus Chemical Industries, Inc., ("S&C") believes that the information herein is factual but is not intended to be all inclusive. The information relates only to the specific material designated and does not relate to its use in combination with other materials or its use as to any particular process. Because safety standards and regulations are subject to change and because S&C has no continuing control over the material, those handling, storing or using the material should satisfy themselves that they have current information regarding the particular way the material is handled, stored or used and that the same is done in accordance with federal, state and local law. S&C makes no warranty, expressed or implied, including (without limitation) warranties with respect to the completeness or continuing accuracy of the information contained herein or with respect to fitness for any particular use.

Material Safety Data Sheet

Manganese metal

ACC# 88704

Section 1 - Chemical Product and Company Identification

MSDS Name: Manganese metal

Catalog Numbers: M78

Synonyms: Colloidal manganese; Magnacat

Company Identification:

Fisher Scientific

1 Reagent Lane

Fair Lawn, NJ 07410

For information, call: 201-796-7100

Emergency Number: 201-796-7100

For CHEMTREC assistance, call: 800-424-9300

For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7439-96-5	Manganese	100%	231-105-1

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: reddish-gray or silvery solid.

Caution! Causes respiratory tract irritation. Causes eye and skin irritation. May cause digestive tract irritation. Moisture sensitive.

Target Organs: Central nervous system.

Potential Health Effects

Eye: Causes eye irritation.

Skin: Causes skin irritation.

Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea.

Inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. May cause motor incoordination and speech abnormalities.

Chronic: Prolonged or repeated inhalation of dusts may cause neurological damage. May cause reproductive and fetal effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts may be combustible when exposed to heat, flame, or oxidizing agents.

Extinguishing Media: Use dry chemical to fight fire. **DO NOT USE WATER!**

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) **Health:** 2; **Flammability:** 1; **Instability:**

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation. Use only in a chemical fume hood.

Storage: Store in a tightly closed container. Keep under a nitrogen blanket.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Manganese	0.2 mg/m3 TWA	1 mg/m3 TWA (fume) 500 mg/m3 IDLH	5 mg/m3 Ceiling (fume)

OSHA Vacated PELs: Manganese: 1 mg/m3 TWA (fume)

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: reddish-gray or silvery

Odor: None reported.

pH: Not available.

Vapor Pressure: 1 mm Hg @ 1292C

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 1900 deg C

Freezing/Melting Point: 1260 deg C

Decomposition Temperature: Not available.

Solubility: Insoluble in water.

Specific Gravity/Density: 7.20

Molecular Formula: Mn

Molecular Weight: 54.938

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, dust generation, moisture, excess heat.

Incompatibilities with Other Materials: Acids; bases; moisture; halogens; phosphorous and sulfur oxides.

Hazardous Decomposition Products: No data available.

Hazardous Polymerization: Has not been reported

Section 11 - Toxicological Information

RTECS#:
CAS# 7439-96-5: 009275000
LD50/LC50:
CAS# 7439-96-5:
Draize test, rabbit, eye: 500 mg/24H Mild;
Draize test, rabbit, skin: 500 mg/24H Mild;
Oral, rat: LD50 = 9 gm/kg;

Carcinogenicity:
CAS# 7439-96-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No data available.
Teratogenicity: No data available.
Reproductive Effects: No data available.
Mutagenicity: No data available.
Neurotoxicity: No data available.
Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7439-96-5 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

None of the chemicals in this material have an RQ.

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

Section 313

This material contains Manganese (CAS# 7439-96-5, 100%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7439-96-5 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XI

Risk Phrases:

R 2 Risk of explosion by shock, friction, fire or other sources of ignition.

R 36/37/38 Irritating to eyes, respiratory system and skin.

R 48 Danger of serious damage to health by prolonged exposure.

Safety Phrases:

S 36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

WGK (Water Danger/Protection)

CAS# 7439-96-5: No information available.

Canada - DSL/NDSL

CAS# 7439-96-5 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 7439-96-5 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997

Revision #3 Date: 10/03/2005

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.



**ALDON
CORPORATION**

221 Rochester Street
Avon, New York 14414-9409
(585) 226-6177

MSDS No.: MM0320
Effective Date: January 12, 2007

MATERIAL SAFETY DATA SHEET

SECTION I NAME 24 HOUR EMERGENCY ASSISTANCE

Product	Mercury Metal		Health	4
Chemical Synonyms	Quick Silver		Fire	0
Formula	Hg		Reactivity	1
Unit Size	up to 500 g.			
C.A.S. No.	7439-97-6			

SECTION II INGREDIENTS OF MIXTURES

Principal Component(s)	%	TLV Units
Mercury metal	100%	See Section V.
DANGER! CORROSIVE! HARMFUL IF INHALED OR		
ABSORBED THROUGH SKIN. VAPOR HIGHLY TOXIC.		

SECTION III PHYSICAL DATA

Melting Point (°F)	-30°C (-38°F)	Specific Gravity (H ₂ O = 1)	13.6
Boiling Point (°F)	357°C (674°F)	Percent Volatile by Volume (%)	100%
Vapor Pressure (mm Hg)	0.002 mm @ 25°C	Evaporation Rate (=1)	N/A
Vapor Density (Air=1)	7.0		
Solubility in Water	Insoluble.		
Appearance & Odor	Silver-white, heavy mobile metallic liquid; no odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	Non-flammable.	Flammable Limits in Air % by Volume	N/A	Lower	Upper
Extinguisher Media	Use any media suitable for extinguishing supporting fire.				

SPECIAL FIREFIGHTING PROCEDURES

In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective clothing. Mercury is non-flammable and non-explosive in air.

(2004 EMERGENCY RESPONSE GUIDEBOOK, RSPA P 5800.9, GUIDE PAGE NO. 172)

UNUSUAL FIRE AND EXPLOSION HAZARDS

Dangerous, when heated mercury evaporates to yield highly toxic fumes of mercury.

SECTION V HEALTH HAZARD DATA MM0320

Threshold Limited Value	TWA: 0.025 mg/m ³ as Hg elemental and inorganic compounds. (ACGIH 2001). Human, oral LDLO 1429 mg/kg.
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Effects of Overexposure	If the mercury in a small clinical thermometer were dispersed in a closed 100' x 100' x 15' room, the TLV would be exceeded. Unsafe conditions are not indicated by odor. Severe poisoning can occur with less than two hours exposure to high concentrations of vapor. Mercury may be absorbed slowly through the skin. Repeated or prolonged contacts may result in poisoning. A single ingestion of a small amount of pure metallic mercury would not be expected to cause severe injury. However, if the mercury contained mercury compounds , poisoning could result. In all cases of overexposure to mercury, get medical attention!! Target organs: Central nervous system, liver, kidneys.
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Emergency and First Aid Procedures	INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person. EYES: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention. SKIN: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention. INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
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SECTION VI REACTIVITY DATA

Stability	Unstable	Conditions to Avoid	Will react slowly with oxygen when heated and it reacts with halogens. Excessive temperature.
	Stable	X	
Incompatibility (Materials to Avoid)	Acetylinic compounds, ammonia, boron, diiodophosphide, ethylene oxide, metals, methyl azide, methylsilane, oxygen, oxidants, nitric acid, tetracarbonylnickel, nitromethane, silver perchlorate.		

Hazardous Decomposition Products	Thermal decomposition products include toxic mercury vapors and oxygen.		
Hazardous Polymerization	Conditions to Avoid		
May Occur	Will Not Occur		
	X	Not applicable.	

SECTION VII SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled	Collect all droplets and pools at once by means of suction pump and aspirator bottle with a long capillary tube. Cover fine droplets in non-accessible cracks with calcium polysulfide and excess sulfur. Combine all contaminated mercury in a tightly stoppered bottle. Clean and recycle.
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Waste Disposal Method	Discharge, treatment, or disposal may be subject to Federal, State or Local laws. These disposal guidelines are intended for the disposal of catalog-size quantities only. Mercury can be purified for reuse, or it can be sold to a mercury salvage company when large amounts are involved. Dispose of in an approved chemical landfill or contract with a licensed waste disposal service.
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SECTION VIII SPECIAL PROTECTION INFORMATION

Respiration Protection (Specify Type)	Work in a fume hood or wear NIOSH/MSHA-approved respirator with mercury cartridge.			
Ventilation	Local Exhaust	Acceptable.	Special	No.
	Mechanical (General)	Preferred.	Other	No.
Protective Gloves	Rubber, Plastic.		Eye Protection	Chemical safety glasses.

Other Protective Equipment	Goggles, smock, apron, eye wash station, ventilation hood, proper gloves.
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SECTION IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling & Storing	Store in a cool, dry place away from fire hazards. Clean up all spills at once. Wash thoroughly after handling.
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Other Precautions	Read label on container before using. Do not wear contact lenses when working with chemicals. For laboratory use only. Not for drug, food or household use. Keep out of reach of children.
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Do not breathe Mercury fumes. Mercury should not be heated without proper precautions to safely handle highly toxic mercury vapor. Remove and wash contaminated clothing.

Revision No.	9	Date	01/12/07	Approved	James A. Bertsch	Chemical Safety Coordinator	JAB
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Material Safety Data Sheet

Nickel Metal

ACC# 16240

Section 1 - Chemical Product and Company Identification

MSDS Name: Nickel Metal

Catalog Numbers: N40-500

Synonyms:

Company Identification:

Fisher Scientific

1 Reagent Lane

Fair Lawn, NJ 07410

For information, call: 201-796-7100

Emergency Number: 201-796-7100

For CHEMTREC assistance, call: 800-424-9300

For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7440-02-0	NICKEL	100.0	231-111-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: white to gray white solid.

Caution! May cause allergic skin reaction. May cause eye irritation. May cause respiratory tract irritation. May cause cancer in humans. May cause liver and kidney damage.

Target Organs: Kidneys, liver, respiratory system.

Potential Health Effects

Eye: May cause eye irritation.

Skin: May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. May cause severe irritation and possible burns. May cause dermatitis.

Ingestion: Causes gastrointestinal irritation with nausea, vomiting and diarrhea.

Inhalation: Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. Inhalation of a mist of this material may cause respiratory tract irritation. Breathing Nickel (Dust and Fume) can cause a sore or hole in the "bone" (septum) dividing the inner nose.

Chronic: Prolonged or repeated skin contact may cause sensitization dermatitis and possible destruction and/or ulceration. May cause respiratory tract cancer.

Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin: Get medical aid if irritation develops or persists. Wash clothing before reuse. Flush skin with plenty of soap and water.

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

Notes to Physician: Treat symptomatically and supportively.

Antidote: There exists several chelation agents. The determination of there use should be made only by qualified medical personnel.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Dust can be an explosion hazard when exposed to heat or flame.

Extinguishing Media: Confining and smothering is preferable to applying water. DO NOT USE WATER, CO₂, OR FOAM DIRECTLY ON FIRE ITSELF. Use DRY sand, sodium chloride powder, graphite powder, copper powder or Lith-X powder. Dousing metallic fires with water may generate hydrogen gas, an extremely dangerous explosion hazard, particularly if fire is in a confined environment.

Flash Point: Not applicable.

Autoignition Temperature: Not applicable.

Explosion Limits, Lower:Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 3; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Very fine particles can cause a fire or explosion. Eliminate all ignition sources. Reduce airborne dust and prevent scattering by moistening with water. Sweep up, then place into a suitable container for disposal. Carefully scoop up and place into appropriate disposal container. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with skin and eyes. Avoid ingestion and inhalation.

Storage: Store in a cool, dry, well-ventilated area away from incompatible substances. Keep containers tightly closed.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
NICKEL	1.5 mg/m3 TWA (inhalable fraction)	0.015 mg/m3 TWA 10 mg/m3 IDLH	1 mg/m3 TWA

OSHA Vacated PELs: NICKEL: 1 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to minimize contact with skin.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: white to gray white

Odor: none reported

pH: Not available.

Vapor Pressure: 1 mm Hg @ 1810 C

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not applicable.

Boiling Point: 2730 deg C

Freezing/Melting Point: 1455 deg C

Decomposition Temperature: Not available.

Solubility: Insoluble in water.

Specific Gravity/Density: 8.90

Molecular Formula: Ni

Molecular Weight: 58.69

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, dust generation.

Incompatibilities with Other Materials: Acids, aluminum, ammonia, ammonium nitrate, bromine pentafluoride, ethylene + aluminum, dioxane, fluorine, hydrazine, hydrazoic acid, hydrogen, methanol, nitric acid, nitryl fluoride, organic solvents, oxidants, phosphorus, potassium perchlorate, selenium, sulfur and compounds.

Hazardous Decomposition Products: Toxic and highly flammable nickel carbonyl.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 7440-02-0: QR5950000; QR6126100; QR6555000; QR7120000

LD50/LC50:

Not available.

Carcinogenicity:

CAS# 7440-02-0:

- **ACGIH:** Not listed.
- **California:** carcinogen, initial date 10/1/89
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Nickel compounds).

Epidemiology: Epidemiological studies have shown an increased incidence of cancers among nickel refinery workers.

Teratogenicity: No information available.

Reproductive Effects: No information available.

Mutagenicity: No information available.

Neurotoxicity: No information available.

Other Studies:

Section 12 - Ecological Information

Ecotoxicity: No data available. No information available.

Environmental: No information reported.

Physical: No information available.

Other: None.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7440-02-0 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 7440-02-0: 100 lb final RQ (no reporting of releases of this hazardous substance is require

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 7440-02-0: immediate, delayed, fire.

Section 313

This material contains NICKEL (CAS# 7440-02-0, 100.0%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 7440-02-0 (listed as Nickel compounds) is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 7440-02-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7440-02-0 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7440-02-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains NICKEL, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN

Risk Phrases:

R 40 Limited evidence of a carcinogenic effect.

R 43 May cause sensitization by skin contact.

Safety Phrases:

- S 22 Do not breathe dust.
- S 36 Wear suitable protective clothing.

WGK (Water Danger/Protection)

CAS# 7440-02-0: No information available.

Canada - DSL/NDSL

CAS# 7440-02-0 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 7440-02-0 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information
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MSDS Creation Date: 3/19/1998

Revision #5 Date: 10/28/2008

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

M A T E R I A L S A F E T Y D A T A S H E E T

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A. D. MACKAY, Inc.
10 NORTH BROADWAY
P.O. BOX 'G'
RED HOOK, N.Y. 12571-0046
(914) 758-1033

SECTION I

FEBRUARY 2006 REVISED

MATERIAL NAME:

VANADIUM (METAL, LUMP, POWDER, Etc.)

MATERIAL FAMILY:

PURE ELEMENT

TSCA:

CAS #: 7440-62-2

EMERGENCY TELEPHONE NO.

1-800-424-9300 (24 HOURS)

FORMULA: UN I.D.#:

V NOT CLASSIFIED

THIS PRODUCT IS LISTED ON THE TOXIC SUBSTANCES CONTROL ACT (TSCA) INVENTORY.

SECTION II - HAZARDOUS INGREDIENTS

TYPICAL COMPOSITION	%	OSHA/PEL*	ACGIH/TLV*
VANADIUM	>99%	0.5 (CEILING), 0.1 (FUME)	0.5

*NONE FOR METAL. THESE VALUES REPRESENT V_2O_5 , AS V (mc/m^3).

SECTION III - PHYSICAL DATA

BOILING POINT	MELTING POINT	SPECIFIC GRAVITY ($H_2O=1$)
3380°C	1890°C	5.96
VAPOR PRESSURE (mm Hg.)	VAPOR DENSITY (AIR=1)	PERCENT VOLATILE BY VOLUME
N/A	N/A	NONVOLATILE
SOLUBILITY IN WATER	BULK DENSITY	EVAPORATION RATE
INSOLUBLE	370 lb/ft ³	N/A
APPEARANCE AND ODOR		AUTOIGNITION TEMPERATURE
LIGHT GRAY OR BLACK LUSTROUS POWDER, OR SILVER GRAY METAL. NO ODOR.		POWDER CAN BE IGNITED AT 3000°C

OTHER COMMENTS:

NOT ATTACKED BY HOT OR COLD HCl. BY COLD H_2SO_4 . SOLUBLE IN HOT H_2SO_4 , IN HYDROFLUORIC ACID, IN NITRIC ACID, IN AQUA REGIA. SLOWLY OXIDIZES IF EXPOSED TO AIR. FORMS V_2O_5 ABOVE 400°C. THE SOLID METAL WILL NOT BURN.

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT:

N/A

FLAMMABLE LIMITS:

N/A

EXTINGUISHING MEDIA:

CLASS 'D' AGENT SUCH AS ANSUL'S MET-L-X DRY POWDER FOR METAL FIRES.

SPECIAL FIRE FIGHTING PROCEDURES:

WEAR MOORE/ASHA APPROVED SELF-CONTAINED BREATHING APPARATUS FOR FIGHTING LARGE METAL FIRES. FIRE CAN BE CONTROLLED BY SMOTHERING WITH DRY TABLE SALT OR USING TYPE D FIRE EXTINGUISHER MATERIAL. DO NOT CONTACT METAL WITH WATER.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

DUST MAY BE HAZARDOUS WHEN EXPOSED TO HEAT OR FLAME. HOT OR BURNING METAL CAN PRODUCE TOXIC FUMES. USE SELF-CONTAINED BREATHING APPARATUS OPERATED IN POSITIVE PRESSURE MODE IF THE FIRE INVOLVED VANADIUM METAL OR OXIDE.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE:

NONE FOR METAL. 0.5 mc/m^3 FOR V_2O_5 , AS V.

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MATERIAL SAFETY DATA SHEET

PAGE 2

MATERIAL: VANADIUM

CONTINUED

A.D. MACKAY, Inc.

SECTION V - HEALTH HAZARD DATA CONTINUED

TOXICITY DATA:

METALLIC VANADIUM IS CONSIDERED NON-TOXIC. HOWEVER, VANADIUM COMPOUNDS, NOTABLY THE PENTOXIDE AND METAVANDATE, ARE HIGHLY TOXIC. FINELY-DIVIDED VANADIUM IS REACTIVE ENOUGH TO CONVERT SLOWLY TO TOXIC FORMS, MAKING CONSIDERATION OF THEIR TOXIC EFFECTS NECESSARY. TOXICITY DATA IS FOR SOLUBLE COMPOUNDS. AS METAL: NON-TOXIC. AS V_2O_5 : INHALATION-RAT LC_{50} : 70 mg/m³/2HR. INHALATION-HUMAN $TCLO$: 1 mg/m³/8HR. - ALLERGIC REACTION. ORAL - RAT LD_{50} : 10 mg/kg.

CARCINOGENICITY:

NTP? NO. IARC MONOGRAPHS? NO. OSHA REGULATED? NO.

ROUTES OF ENTRY:

INHALATION: YES. INGESTION: YES. SKIN ABSORPTION: NO. SKIN/EYE

CONTACT: YES.

TARGET ORGANS:

AS SOLUBLE VANADIUM COMPOUNDS: LUNGS, LIVER, KIDNEY, BONE MARROW, ADRENALS.

EFFECTS OF OVEREXPOSURE: THE PENTOXIDE DUST HAS BEEN REPORTED TO BE A RESPIRATORY IRRITANT AND TO CAUSE SKIN PALLOR, GREENISH-BLACK TONGUE, CHEST PAIN, COUGH, DYSPNEA, PALPITATION, AND LUNG CHANGES. WHEN INGESTED CAUSES GASTRO INTESTINAL DISTURBANCES. **ACUTE (AS SOLUBLE VANADIUM COMPOUNDS):** IRRITATION OF EYES, NOSE, THROAT AND RESPIRATORY TRACT, BRONCHITIS WITH WHEEZING AND CHEST PAIN. ALSO AFFECTS NERVOUS SYSTEM. CAN CAUSE HEMORRHAGE, PARALYSIS, CONVULSIONS AND RESPIRATORY DEPRESSION (IN SEVERE EXPOSURES). **CHRONIC (AS SOLUBLE VANADIUM COMPOUNDS):** CHRONIC BRONCHITIS, ALLERGIC SKIN REACTION, CHRONIC OBSTRUCTION PULMONARY DISEASE.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:

NO DATA

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: AS METAL POWDER OR AS V_2O_5 , REMOVE TO FRESH AIR. GIVE OXYGEN IF BREATHING IS DIFFICULT. PERFORM CPR AS NECESSARY. TREAT FOR SHOCK. SEEK IMMEDIATE MEDICAL ATTENTION. **EYE CONTACT:** AS METAL POWDER OR V_2O_5 , FLUSH EYES IMMEDIATELY WITH WATER FOR AT LEAST 15 MINUTES. SEEK IMMEDIATE MEDICAL ATTENTION. **SKIN CONTACT:** REMOVE CONTAMINATED CLOTHING. WASH AFFECTED AREA THOROUGHLY WITH SOAP OR MILD DETERGENT AND WATER. SEEK IMMEDIATE MEDICAL ATTENTION. **INGESTION:** SEEK IMMEDIATE MEDICAL ATTENTION.

NOTES TO PHYSICIAN (INCLUDING ANTIDOTES): INHALATION OR INGESTION OF METALLIC VANADIUM (AS POWDER) POSES NO THREAT AS SUCH. THE MATERIAL COULD REACT WITH BODY FLUIDS, HOWEVER, TO PRODUCE TOXIC COMPOUNDS IN SITU. CALCIUM DIOXIDE (DIA) HAS BEEN SHOWN TO BE ANTIDOTAL IN ANIMAL STUDIES OF VANADIUM COMPOUNDS. ASCORBIC ACID WAS BENEFICIAL IN STUDIES OF VANADIUM IN HUMANS. OTHER TREATMENT SHOULD BE DIRECTED TO RELIEF OF SYMPTOMS, PRIMARILY RELATED TO THE IRRITATION OF MUCOUS MEMBRANES. INHALATION OF TOXIC LEVELS OF VANADIUM COMPOUNDS MAY CAUSE INCREASED SUSCEPTIBILITY TO RESPIRATORY INFECTION.

SECTION VI - REACTIVITY DATA

STABILITY Unstable ; **CONDITIONS TO AVOID:**

Stable ; XXX HEAT, SPARKS AND OPEN FLAMES.

INCOMPATIBILITY (materials to avoid)

POWDER OXIDIZES SLOWLY IF EXPOSED TO AIR, FORMS V_2O_5 ABOVE 400°C. VANADIUM SHOULD BE KEPT AWAY FROM OXIDIZERS. VANADIUM WILL REACT VIOLENTLY WITH CHLORINE ABOVE 180°C. IS READILY DISSOLVED BY NITRIC ACID AND SLOWLY OXIDIZES IF THE SURFACE IS MOIST. POWDER EXPLODES ON CONTACT AT 0°C WITH LIQUID Cl_2 AND CAUSES INCANDESCENCE WITH Br_2 .

HAZARDOUS DECOMPOSITION PRODUCTS:

NONE KNOWN

HAZARDOUS MAY OCCUR ; **CONDITIONS TO AVOID:**

POLYMER- WON'T OCCUR ; XXX N/A

IZATION

Continued on Page 3

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MATERIAL: VANADIUM

CONTINUED

A.D. MACKAY, Inc.

SECTION VII - SPILL OR LEAK PROCEDURE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

USE NORMAL CLEAN-UP PROCEDURES WHICH MINIMIZE EXPOSURE IS APPLICABLE. DO NOT CAUSE DUSTS TO FORM. SEGREGATE MATERIAL, SWEEP UP OR VACUUM AND DISPOSE.

WASTE DISPOSAL METHOD:

CONSULT FEDERAL, STATE OR LOCAL AUTHORITIES FOR PROPER 'DISPOSAL' PROCEDURES

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)

FOR OPERATIONS SUCH AS GRINDING OR POLISHING, WHICH WILL PRODUCE DUSTS OF METAL POWDER OR OXIDE ABOVE 0.5 mg/m³: IN CONCENTRATIONS LESS THAN 25 mg/m³: A HIGH EFFICIENCY PARTICULATE FILTER RESPIRATOR WITH A FULL FACEPIECE. IN CONCENTRATIONS LESS THAN 70 mg/m³: A POWDERED AIR-PURIFYING RESPIRATOR WITH A FULL FACEPIECE AND A HIGH EFFICIENCY PARTICULATE FILTER. IN CONCENTRATIONS GREATER THAN 70 mg/m³: SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE. USE ONLY NIOSH/MSHA APPROVED EQUIPMENT.

VENTILATION	LOCAL EXHAUST RECOMMENDED - FUME	SPECIAL
	HOOD FOR DUSTS OR FUMES	N/A
	MECHANICAL (general)	OTHER
	RECOMMENDED	N/A

PROTECTIVE GLOVES

MSHA/NIOSH APPROVED RUBBER GLOVES

EYE PROTECTION: MSHA/NIOSH
APPROVED EYE GOGGLES/MASK

OTHER PROTECTIVE EQUIPMENT:

WORK UNIFORM, NON-FLAMMABLE, WITHOUT POCKETS AND CUFFS. NORMAL LABORATORY WEAR. EYEWASH STATION CAPABLE OF SUSTAINED FLUSHING.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:

STORE IN AN INERT ATMOSPHERE TO PREVENT OXIDIZATION, SUCH AS ARGON GAS. KEEP MATERIAL DRY. IF MACHINING CHIPS OR RESIDUES HAVE DEVELOPED A GREEN-BLACK OXIDE SURFACE FILM, THIS OXIDE SHOULD BE CAREFULLY REMOVED BY PICKLING BEFORE FURTHER HANDLING OR PROCESSING OF THE METAL. FINELY GROUND MATERIAL SHOULD BE KEPT FROM HEAT, SPARKS AND FLAMES.

OTHER PRECAUTIONS:

WASH THOROUGHLY AFTER USAGE. CHANGE FROM WORK UNIFORM TO STREET CLOTHING PRIOR TO LEAVING WORK AREAS. CLEANLINESS AND GOOD HOUSEKEEPING ARE IMPORTANT TO MINIMIZE OXIDE DUST LEVELS. EATING AND SMOKING SHOULD NOT BE PERMITTED IN AREAS WHERE VANADIUM DUSTS ARE PRESENT. WASH HANDS THOROUGHLY BEFORE EATING, SMOKING, OR USING TOILET FACILITIES.

REMEMBER -- SAFETY IS -- NO ACCIDENT

A NOTE CONCERNING HANDLING AND PRECAUTIONS OF SOME METALS & CHEMICALS, Etc.



Some of the metals and chemicals listed herein are research or experimental substances which may be TOXIC, as defined by various governmental regulations. In accordance with Environmental Protection Agency regulations, these materials should only be handled by, or under the direct supervision of a "TECHNICALLY QUALIFIED INDIVIDUAL," as defined in 40 CFR, par. 710.2(aa).

The above information is accurate to the best of our knowledge. However, since data, safety standards, and government regulations are subject to change and the conditions of handling and use, or misuse are beyond our control, A. D. MACKAY, Inc. MAKES NO WARRANTY, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE COMPLETENESS OR CONTINUING ACCURACY OF THE INFORMATION CONTAINED HEREIN AND DISCLAIMS ALL LIABILITY FOR RELIANCE THEREON. User should satisfy himself that he has all current data relevant to his/her particular use.



GARDENA, CA
NEW BRUNSWICK, NJ

Material Safety Data Sheet

NFPA	HMIS	Personal Protective Equipment						
	<table><tr><td>Health Hazard</td><td>1</td></tr><tr><td>Fire Hazard</td><td>0</td></tr><tr><td>Reactivity</td><td>1</td></tr></table>	Health Hazard	1	Fire Hazard	0	Reactivity	1	 See Section 15.
Health Hazard	1							
Fire Hazard	0							
Reactivity	1							

Section 1. Chemical Product and Company Identification

Page Number: 1

Common Name/ Trade Name	Zinc Metal	Catalog Number(s).	YY053, Z1020, Z1033, Z1035, Z1040, Z1043
Manufacturer	SPECTRUM LABORATORY PRODUCTS INC. 14422 S. SAN PEDRO STREET GARDENA, CA 90248	CAS#	7440-66-6
Commercial Name(s)	Not available.	RTECS	ZG8600000
Synonym	Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips; Zinc Foil	TSCA	TSCA 8(b) inventory: Zinc Metal
Chemical Name	Zinc	CI#	Not applicable.
Chemical Family	Metal.	IN CASE OF EMERGENCY CHEMTREC (24hr) 800-424-9300 CALL (310) 516-8000	
Chemical Formula	Zn		
Supplier	SPECTRUM LABORATORY PRODUCTS INC. 14422 S. SAN PEDRO STREET GARDENA, CA 90248		

Section 2. Composition and Information on Ingredients

Name	CAS #	Exposure Limits			% by Weight
		TWA (mg/m ³)	STEL (mg/m ³)	CEIL (mg/m ³)	
1) Zinc Metal	7440-66-6				100

Toxicological Data on Ingredients	Zinc Metal LD50: Not available. LC50: Not available.
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Section 3. Hazards Identification

Potential Acute Health Effects	Slightly hazardous in case of skin contact (irritant), of ingestion. Non-irritating to the eyes. Non-hazardous in case of inhalation.
Potential Chronic Health Effects	CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Continued on Next Page

Section 4. First Aid Measures

Eye Contact	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin Contact	Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.
Serious Skin Contact	Not available.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Serious Inhalation	Not available.
Ingestion	Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.
Serious Ingestion	Not available.

Section 5. Fire and Explosion Data

Flammability of the Product	Non-flammable.
Auto-Ignition Temperature	Not applicable.
Flash Points	Not available.
Flammable Limits	Not available.
Products of Combustion	Not available.
Fire Hazards in Presence of Various Substances	Slightly flammable to flammable in presence of oxidizing materials, of acids, of alkalis, of moisture. Non-flammable in presence of shocks.
Explosion Hazards in Presence of Various Substances	Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.
Fire Fighting Media and Instructions	Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.
Special Remarks on Fire Hazards	Zinc + NaOH causes ignition. Oxidation of zinc by potassium proceeds with incandescence. Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper. Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined. When hydrazine mononitrate is heated in contact with zinc, a flaming decomposition occurs at temperatures a little above its melting point. Contact with acids and alkali hydroxides (sodium hydroxide, potassium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas. Zinc foil ignites if traces of moisture are present. It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or moist air.
Special Remarks on Explosion Hazards	Not available.

Section 6. Accidental Release Measures

Small Spill	Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.
Large Spill	Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7. Handling and Storage

Precautions	Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8. Exposure Controls/Personal Protection

Engineering Controls	Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.
Personal Protection	Safety glasses. Lab coat. Gloves (impervious).
Personal Protection in Case of a Large Spill	Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.
Exposure Limits	Not available.

Section 9. Physical and Chemical Properties

Physical state and appearance	Solid. (Lustrous solid. Metal solid.)	Odor	Not available.
Molecular Weight	65.39 g/mole	Taste	Not available.
pH (1% soln/water)	Not applicable.	Color	Bluish-grey
Boiling Point	907°C (1664.6°F)		
Melting Point	419°C (786.2°F)		
Critical Temperature	Not available.		
Specific Gravity	Not available.		
Vapor Pressure	Not applicable.		
Vapor Density	Not available.		
Volatility	Not available.		
Odor Threshold	Not available.		
Water/Oil Dist. Coeff.	Not available.		
Ionicity (in Water)	Not available.		
Dispersion Properties	Not available.		
Solubility	Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.		

Section 10. Stability and Reactivity Data

Stability	The product is stable.
Instability Temperature	Not available.
Conditions of Instability	Excess heat, incompatible materials, moisture
Incompatibility with various substances	Reactive with oxidizing agents, acids, alkalis. Slightly reactive to reactive with moisture. The product may react violently with water to emit flammable but non toxic gases.
Corrosivity	Non-corrosive in presence of glass.
Special Remarks on Reactivity	Incompatible with acids, halogenated hydrocarbons, NH_4NO_3 , barium oxide, $\text{Ba}(\text{NO}_3)_2$, Cadmium, CS_2 , chlorates, Cl_2 , CrO_3 , F_2 , Hydroxylamine, $\text{Pb}(\text{N}_3)_2$, MnCl_2 , HNO_3 , performic acid, KClO_3 , KNO_3 , N_2O_2 , Selenium, NaClO_3 , Na_2O_2 , Sulfur, Te, water, $(\text{NH}_4)_2\text{S}$, As_2O_3 , CS_2 , CaCl_2 , chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl , H_2SO_4 , $(\text{Mg} + \text{Ba}(\text{NO}_3)_2 + \text{BaO}_2)$, (ethyl acetoacetate +tribromoneopentyl alcohol. Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen. Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide. May react with water.
Special Remarks on Corrosivity	Not available.
Polymerization	Will not occur.

Section 11. Toxicological Information

Routes of Entry	Inhalation. Ingestion.
Toxicity to Animals	LD50: Not available. LC50: Not available.
Chronic Effects on Humans	Not available.
Other Toxic Effects on Humans	Slightly hazardous in case of skin contact (irritant), of ingestion. Non-hazardous in case of inhalation.
Special Remarks on Toxicity to Animals	Lowest Published Lethal Dose: LDL [Duck] - Route: Oral; Dose: 388 mg/kg
Special Remarks on Chronic Effects on Humans	Not available.
Special Remarks on other Toxic Effects on Humans	Acute Potential Health Effects Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss. Eyes: Zinc in the forms of Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips; Zinc Foil; Zinc Metal sticks; Zinc Metal, mossy are not expected to get into the eyes and cause eye irritation. Ingestion: May be harmful if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain, fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derangement in cerebellar function, lightheadedness, dizziness, irritability, muscular stiffness, and pain. May also affect blood. Inhalation: Not an inhalation hazard in forms of Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips; Zinc Foil; Zinc Metal sticks; Zinc Metal, mossy when handled under normal conditions. Inhalation of zinc dust or fumes (if metal is smelted) may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headachefever, malaise, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis. The toxicological properties of this substance have not been fully investigated.


Section 12. Ecological Information

Ecotoxicity	Not available.
BOD5 and COD	Not available.
Products of Biodegradation	Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
Toxicity of the Products of Biodegradation	Not available.
Special Remarks on the Products of Biodegradation	Not available.

Section 13. Disposal Considerations

Waste Disposal	Waste must be disposed of in accordance with federal, state and local environmental control regulations.
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Section 14. Transport Information

DOT Classification	Not a DOT controlled material (United States).
Identification	Not applicable.
Special Provisions for Transport	Not applicable.
DOT (Pictograms)	

Section 15. Other Regulatory Information and Pictograms

Federal and State Regulations	New York release reporting list: Zinc Metal Rhode Island RTK hazardous substances: Zinc Metal Pennsylvania RTK: Zinc Metal Florida: Zinc Metal Michigan critical material: Zinc Metal Massachusetts RTK: Zinc Metal New Jersey: Zinc Metal California Director's List of Hazardous Substances: Zinc Metal TSCA 8(b) inventory: Zinc Metal TSCA 12(b) one time export: Zinc Metal SARA 313 toxic chemical notification and release reporting: Zinc Metal CERCLA: Hazardous substances: Zinc Metal: 1000 lbs. (453.6 kg)
California Proposition 65 Warnings	California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: No products were found. California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: No products were found.
Other Regulations	EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances (EINECS No. 231-175-3). Canada: Listed on Canadian Domestic Substance List (DSL). China: Listed on National Inventory. Japan: Not listed on National Inventory (ENCS). Korea: Listed on National Inventory (KECI). Philippines: Listed on National Inventory (PICCS). Australia: Listed on AICS.
Other Classifications	WHMIS (Canada) Not Available

Continued on Next Page

DSCL (EEC)

R15- Contact with water liberates extremely flammable gases.
R17- Spontaneously flammable in air.

S7/8- Keep container tightly closed and dry.

HMS (U.S.A.)

Health Hazard	1
Fire Hazard	0
Reactivity	1
Personal Protection	B

National Fire Protection Association (U.S.A.)

Health



Flammability

Reactivity

Specific hazard

**WHMIS (Canada)
(Pictograms)****DSCL (Europe)
(Pictograms)****TDG (Canada)
(Pictograms)****ADR (Europe)
(Pictograms)****Protective Equipment**

Gloves



Lab coat.



Not applicable.
Safety glasses.

Section 16. Other Information**MSDS Code** Z5025**References** Not available.**Other Special Considerations** Not available.

Validated by Sonia Owen on 6/25/2009.

Verified by Sonia Owen.

Printed 6/25/2009.

CALL (310) 516-8000

Notice to Reader

All chemicals may pose unknown hazards and should be used with caution. This Material Safety Data Sheet (MSDS) applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this MSDS. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this MSDS is based on technical data judged to be reliable, Spectrum Quality Products, Inc. assumes no responsibility for the completeness or accuracy of the information contained herein.

APPENDIX C

JOB SAFETY ANALYSIS (JSA)

DOCUMENTS

To be provided with Remedial Investigation/Work Plan or as required by Site activities.

APPENDIX F

HASP - JOB SAFETY ANALYSIS FORMS

SAN JACINTO RIVER WASTE PITS

SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency – Region 6

On behalf of:

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

Field Activities

Project Name: San Jacinto River Waste Pits	Project Number: 090557-01	JSA Number: 001	Issue Date: June 21, 2010
Location: San Jacinto River, Harris County, Texas	Contractor: Anchor QEA	Analysis by: Randy Brown	Analysis Date: June 10, 2010
Work Operation: Field Activities	Superintendent/Competent Person: Jason Kase	Revised by: Chris Torell	Revised Date: June 16, 2010
Required Personal Protective Equipment (PPE): <ul style="list-style-type: none"> Modified Level D - Long pants, long sleeves if handling potentially contaminated media, and steel-toed boots. Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, Tyvek coveralls, and U.S. Coast Guard-approved personal flotation device (PFD). Heat stress hazards will be considered when selecting PPE. 		Reviewed by: Chris Torell	Reviewed Date: June 16, 2010
		Approved by: Chris Torell	Approved Date: June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, Physical Activity	Slips, Trips, Falls	<ul style="list-style-type: none"> Be aware of potentially slippery or uneven surfaces and tripping hazards. Wear footwear that has sufficient traction to reduce risk of slipping. Wear steel-toed rubber boots versus over-the-shoe rubber boots. Work slowly during transit. Jumping, running, and horseplay are prohibited. Keep all areas clean and free of debris to deter any unnecessary trips and falls. Clean up all spills immediately. Notify the SSO of any unsafe conditions. 	<ul style="list-style-type: none"> Routinely inspect work area for hazards.

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Heat Stress (see HASP Section 12.2)	<ul style="list-style-type: none"> Adjust work schedules, as necessary. Perform work during cooler hours of the day if possible or at night if possible and if adequate lighting can be provided. Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. Keep plenty of fluids onsite and stay hydrated. Train workers to recognize the symptoms of heat related illness. 	<ul style="list-style-type: none"> Monitor workers' physical conditions. Monitor outside temperature versus worker activity.
	Sunshine	<ul style="list-style-type: none"> Have sunscreen available for ultraviolet protection. Have adequate drinking water available to prevent dehydration. Have tinted safety glasses available. 	<ul style="list-style-type: none"> Routinely inspect for sunburn.
	Rain	<ul style="list-style-type: none"> Have appropriate rain gear available. Be aware of slip hazards, puddles, and electrical hazards when working near water. 	<ul style="list-style-type: none"> Inspect PPE daily prior to potential use.
	Lightning	<ul style="list-style-type: none"> Have adequate shelter available during a thunderstorm. Do not conduct work on or over water during a thunderstorm; immediately head for shore if on the water and lightning is observed. Do not begin or continue work until lightning subsides for 20 minutes. If unable to get to shore, disconnect and do not use or touch major electronic equipment, including the radio, throughout the duration of the storm. 	<ul style="list-style-type: none">

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	High Winds/Dust Storm	<ul style="list-style-type: none"> Wear goggles if dust/debris is visible. 	<ul style="list-style-type: none">
	Pollen	<ul style="list-style-type: none"> Take medication (e.g. anti-histamine) to minimize allergic reaction to pollen. If necessary, wear a dust mask. 	<ul style="list-style-type: none"> Inspect PPE daily prior to potential use.
	Biological Hazards (flora [poison ivy, poison oak, etc.] and fauna [ticks, bees, mosquitoes, snakes, etc.])	<ul style="list-style-type: none"> Personnel will be aware of potential exposure to biological hazards. Wear appropriate clothing (hat, long-sleeve shirt, long pants, leather gloves, boots, Tyvek coveralls, as appropriate) and insect repellent. Personnel will wear thick gloves when clearing plants or debris from work area. 	<ul style="list-style-type: none"> Routinely inspect work area, particularly upon first entering.
	Noise	<ul style="list-style-type: none"> Maintain adequate distance from heavy equipment. Wear ear plugs or ear muffs, if appropriate, based on noise levels. 	<ul style="list-style-type: none"> Inspect PPE daily prior to use.
	River/Drowning	<ul style="list-style-type: none"> Observe water depth and speed of current before beginning work. Wear U.S. Coast Guard approved personal flotation device (PFD) as appropriate. 	<ul style="list-style-type: none"> Inspect PPE daily prior to use.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

Construction Observation Activities

Project Name: San Jacinto River Waste Pits	Project Number: 090557-01	JSA Number: 002	Issue Date: June 21, 2010
Location: San Jacinto River, Harris County, Texas	Contractor: Anchor QEA	Analysis by: Randy Brown	Analysis Date: June 10, 2010
Work Operation: Construction Observation Activities	Superintendent/Competent Person: Jason Kase	Revised by: Chris Torell	Revised Date: June 16, 2010
Required Personal Protective Equipment (PPE): <ul style="list-style-type: none"> Modified Level D – Long pants, long sleeves if handling potentially contaminated media, hard hat, safety glasses, and steel toed boots. Depending on activity, the following may also be required: hearing protection, U.S. Coast Guard-approved personal flotation device (PFD), Tyvek coveralls, and nitrile outer gloves and latex inner gloves. Heat stress hazards will be considered when selecting PPE. 		Reviewed by: Chris Torell	Reviewed Date: June 16, 2010
		Approved by: Chris Torell	Approved Date: June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Construction Observation Activities - Materials and Equipment	Slips, Trips, Falls	<ul style="list-style-type: none"> Be aware of potentially slippery or uneven surfaces and tripping hazards. Wear footwear that has sufficient traction to reduce risk of slipping. Wear steel-toed rubber boots versus over-the-shoe rubber boots. Work slowly during transit. Jumping, running, and horseplay are prohibited. Keep all areas clean and free of debris to deter any unnecessary trips and falls. Do not walk with head down; stand in place when making notes or talking on cell phone. Clean up all spills immediately. Notify the SSO immediately of any unsafe conditions. 	<ul style="list-style-type: none">

Construction Observation Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Traffic/Heavy Equipment Hazards	<ul style="list-style-type: none"> • Maintain a safe distance during loading/unloading operations. • Establish eye contact with equipment operator before moving into their area of operation. • Use spotters to assist trucks and equipment attempting to position themselves in areas with spatial constraints. 	<ul style="list-style-type: none"> •
	Exposure to Contaminated Materials	<ul style="list-style-type: none"> • Avoid contact with contaminated materials. • Use proper PPE (e.g. gloves) if coming into contact with contaminated materials. • Stay upwind of equipment handling contaminated materials whenever possible. • Properly decontaminate equipment that comes into contact with contaminated materials (consult JSA 008). 	<ul style="list-style-type: none"> • Inspect PPE daily prior to use.
Outdoor, physical activity	Various	<ul style="list-style-type: none"> • Consult JSA 001 for general field activities. 	<ul style="list-style-type: none"> •

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

Motor Vehicle Operation

Project Name: San Jacinto River Waste Pits	Project Number: 090557-01	JSA Number: 003	Issue Date: June 21, 2010
Location: San Jacinto River, Harris County, Texas	Contractor: Anchor QEA	Analysis by: Randy Brown	Analysis Date: June 10, 2010
Work Operation: Motor Vehicle Operation	Superintendent/Competent Person: Jason Kase	Revised by: Chris Torell	Revised Date: June 16, 2010
Required Personal Protective Equipment (PPE): • Seat belt		Reviewed by: Chris Torell	Reviewed Date: June 16, 2010
		Approved by: Chris Torell	Approved Date: June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Driving to, from, and within the project Site	Vehicular Accident	<ul style="list-style-type: none"> Plan your travel route and check maps for directions or discuss with colleagues. Clean windows and mirrors, as needed throughout the trip. Wear seat belt. Wear sun glasses, as needed. Follow vehicle maintenance schedule to reduce possibilities of breakdown while driving. Avoid distractions while driving. 	<ul style="list-style-type: none"> Inspect fluid levels, air pressure in tires, adjust mirrors and seat position appropriately, and maintain adequate fuel level. Check around vehicle for obstructions before starting.
	Distraction While Driving	<ul style="list-style-type: none"> Stop driving vehicle, regardless of speed (i.e., even 5 mph or less) or location (i.e., even if private road), when the potential for being distracted by conversation exists. Drivers are prohibited from using hand-held communication devices (e.g., cell phones) while operating any motor vehicle. 	<ul style="list-style-type: none">

Motor Vehicle Operation

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Fatigue	<ul style="list-style-type: none"> • Get adequate rest prior to driving. • Maintain alertness by changing seat position regularly, stretching, opening a window, adjusting the radio volume, or other techniques as appropriate. • If experiencing drowsiness, pull over at a safe location and rest. 	•
	Inclement Weather/Road Conditions	<ul style="list-style-type: none"> • Check weather and road conditions prior to driving. • If conditions change, be prepared to adjust driving. • Allow extra distance between your vehicle and the vehicle ahead. • Travel in daylight hours, if possible. • Use lights at night and lights/wipers during inclement weather. 	•
	Heavy Traffic	<ul style="list-style-type: none"> • If available, listen to traffic reports prior to driving. Adjust planned travel route if necessary. • Maintain adequate following distance to allow time for slow downs, due to construction, accidents, or other unforeseen circumstances. • Take alternate route to avoid congested areas if necessary. 	•

Motor Vehicle Operation

Training Requirements:

- All drivers are required to have a valid driver's license.
- All vehicles registered in Texas must have vehicle registration and inspection stickers.
- Use of hand-held wireless devices is prohibited while driving any vehicle for any use at any time, and as defined by law.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

Boat/Barge Activities

Project Name: San Jacinto River Waste Pits	Project Number: 090557-01	JSA Number: 004	Issue Date: June 21, 2010
Location: San Jacinto River, Harris County, Texas	Contractor: Anchor QEA	Analysis by: Randy Brown	Analysis Date: June 10, 2010
Work Operation: Boat/Barge Activities	Superintendent/Competent Person: Jason Kase	Revised by: Chris Torell	Revised Date: June 16, 2010
Required Personal Protective Equipment (PPE): <ul style="list-style-type: none"> Modified Level D – safety glasses, steel toed boots, long pants. U.S. Coast Guard-approved personal flotation device (PFD). Depending on activity, the following may also be required: hard hat nitrile outer gloves and latex inner gloves, Tyvek coveralls. 		Reviewed by: Chris Torell	Reviewed Date: June 16, 2010
		Approved by: Chris Torell	Approved Date: June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Boat/Barge Activities	Marine Operation Hazards	<ul style="list-style-type: none"> Equip all water vessels in accordance with U.S. Coast Guard regulations. 	<ul style="list-style-type: none"> Perform daily review of the Boating Checklist.
Navigation	Boat Traffic	<ul style="list-style-type: none"> Maintain a safe operating distance from shoreline, other vessels, etc. 	<ul style="list-style-type: none">
	Waves, Surges, Currents	<ul style="list-style-type: none"> Be aware of sudden surges caused by incoming waves, unstable waters, and currents. 	<ul style="list-style-type: none">
	Capsize Boat	<ul style="list-style-type: none"> Keep weight in boat evenly distributed. Be conscious of shallow water conditions in and near project site and operate boat with care in shallow-water areas. Keep boat speed at reasonable level. Avoid areas with heavy debris or vegetation. Allow only experienced operators to dock and launch boats. 	<ul style="list-style-type: none">

Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Fire or Major Emergency – Abandon Ship	<ul style="list-style-type: none"> • Be prepared to abandon ship in the event of fire that is too large to control with fire extinguisher or other major emergency. • Only the boat captain can order abandon ship. • Communicate intent to abandon ship to all personnel on board. • Call 911. • Notify nearby vessels of intent to abandon ship. • Notify Project Manager and CHSO, if time permits. • Be aware of position of the propeller before abandoning ship. • Identify a rally point for all personnel. • Use the buddy system to support injured personnel. 	<ul style="list-style-type: none"> • Abandon Ship drill should be done on an annual basis.

Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Loading/unloading equipment onto vessel	General	<ul style="list-style-type: none"> • Secure boat. • Use rails or have someone on the dock assist. • Be cautious when entering or exiting the vessel. With one hand on the boat, quickly lower straight down into the center of the craft. Never jump into or off of a vessel. • If others are boarding, have them step along the fore-and aft centerline of the boat while the boat is held in place along the pier. • Avoid directly carrying anything on or off the vessel. Load the items off the pier or have someone hand them to you one by one. • Never overload the vessel. • Keep weight toward center of the boat and center of gravity as low as possible. • Distribute equipment evenly on vessel. 	<ul style="list-style-type: none"> •
Sampling Activities	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of potentially slippery surfaces and tripping hazards. • Wear footwear that has sufficient traction to reduce risk of slipping. • Wear steel-toed rubber boots versus over-the-shoe rubber boots. • Work slowly during transit. Jumping, running, and horseplay are prohibited. • Proceed carefully on floating docks and ramps. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Clean up all spills immediately. • Notify the SSO immediately of any unsafe conditions. 	<ul style="list-style-type: none"> • Routinely inspect work area for hazards.

Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Falls Off Boat/Drowning Hazards	<ul style="list-style-type: none"> Wear footwear that has sufficient traction to reduce risk of slipping. Wear personal flotation device. Be aware of any obstacles on boat deck. 	<ul style="list-style-type: none"> Inspect PFDs daily prior to use.
	Man Overboard	<ul style="list-style-type: none"> Yell "man overboard". If the engine is running, take it out of gear and swing the stern clear to keep from hitting the person. Call 911, as appropriate. Assign a spotter to keep the person in sight at all times. Contact nearby vessels for assistance. Throw flotation devices immediately. Recover person from water. If you fall overboard, hold your mouth and nose closed and protect your head. When you reach the surface, look for movement, listen for sounds and call for help. If available, use the whistle attached to the PFD, and activate the beacon light. It is only sensible to swim if there is reason to believe that a chance of reaching your destination exists. Wear personal flotation device. 	<ul style="list-style-type: none"> Man Overboard drill should be done on an annual basis.
	Muscle strain/injury from improper lifting	<ul style="list-style-type: none"> Utilize proper lifting techniques or ask for assistance with moving/lifting objects. Load and unload items from the boat one by one. Have someone hand them to you. 	<ul style="list-style-type: none">

Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Heat Stress (see HASP Section 12.2)	<ul style="list-style-type: none"> Adjust work schedules, as necessary. Perform work during cooler hours of the day if possible or at night if possible and if adequate lighting can be provided. Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. Keep plenty of fluids onsite; stay hydrated. Train workers to recognize the symptoms of heat related illness. 	<ul style="list-style-type: none"> Monitor workers physical conditions. Monitor outside temperature versus worker activity.
	Rain	<ul style="list-style-type: none"> Have appropriate rain gear available. Be aware of slip hazards, puddles, and electrical hazards when working near water. 	<ul style="list-style-type: none"> Inspect PPE daily prior to use.
	Sunshine	<ul style="list-style-type: none"> Have sunscreen available for ultraviolet protection. Have adequate drinking water available to prevent dehydration. Have tinted safety glasses available. 	<ul style="list-style-type: none"> Routinely inspect for sunburn.
	Fog	<ul style="list-style-type: none"> Wait for fog to lift and there is adequate visibility before operating sampling vessel. 	<ul style="list-style-type: none"> Inspect boat lights.

Boat/Barge Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Lightning	<ul style="list-style-type: none">• Have adequate shelter available during a thunderstorm.• Do not conduct work on or over water during a thunderstorm; immediately head for shore if on the water and lightning is observed.• Do not begin or continue work until lightning subsides for 20 minutes.• If unable to get to shore, disconnect and do not use or touch major electronic equipment, including the radio, throughout the duration of the storm.	<ul style="list-style-type: none">•

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators must have successfully completed a safe boating course.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.



Daily Boat Checklist

Date: _____ Completed by: _____

Boat ID: _____

Item	Yes	No	N/A	Comments
Vessel Registration Numbers Displayed				
Vessel Registration Documentation on Board				
PFDs – One Available Per Person				
PFDs – Condition/Inspection				
First Aid Kit				
Eye Wash Solution				
Fire Extinguisher				
Visual Distress Signal				
Sound Producing Device				
Navigation Lights				
Paddle				
Rescue Ring				
Project Health and Safety Plan				
Cellular phone				
Spill Kit				
PPE (Hard hats, safety glasses, steel toe boots, etc.)				
Cold Weather Suit				
GFI				
Radio Check				
Clear Deck, Work Area				

Comments: _____

Boat/Barge Fueling

Project Name: San Jacinto River Waste Pits	Project Number: 090557-01	JSA Number: 005	Issue Date: June 21, 2010
Location: San Jacinto River, Harris County, Texas	Contractor: Anchor QEA	Analysis by: Randy Brown	Analysis Date: June 10, 2010
Work Operation: Boat/Barge Fueling	Superintendent/Competent Person: Jason Kase	Revised by: Chris Torell	Revised Date: June 16, 2010
Required Personal Protective Equipment (PPE): <ul style="list-style-type: none"> Modified Level D – safety glasses/splash goggles, steel toed boots, long pants, nitrile outer gloves and latex inner gloves. U.S. Coast Guard approved-personal flotation device (PFD). Depending on the activity, may also require hard hat and Tyvek coveralls. Heat stress hazards will be considered when selecting PPE. 		Reviewed by: Chris Torell	Reviewed Date: June 16, 2010
		Approved by: Chris Torell	Approved Date: June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Boat/Barge Activities	Marine Operation Hazards	<ul style="list-style-type: none"> Equip all water vessels in accordance with U.S. Coast Guard regulations. 	<ul style="list-style-type: none"> Perform daily review of the Boating Checklist.
Navigation	Boat Traffic, Waves, Surges, or Currents, Capsize Boat	<ul style="list-style-type: none"> Do not operate boat during fueling operations. Turn off motor and equipment in boat. 	<ul style="list-style-type: none">
Boat/Barge Fueling	Overflow/spills of fuel in or onto boat or water	<ul style="list-style-type: none"> Ensure that fuel pumps have a UL-listed automatic closing valve. Use approved safety containers. Be aware of the capacity of fuel tank/container. Have spill kit available. 	<ul style="list-style-type: none"> Follow operations manual maintenance and inspection procedures for each piece of equipment used on site.

Boat/Barge Fueling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Explosion	<ul style="list-style-type: none">• Use approved safety containers to store and transport fuel.• No smoking on site or open flame within 50 feet.• Shut down equipment/motors that use flammable fuel during fueling, servicing, or maintenance activities.	<ul style="list-style-type: none">•
	Spill on clothing	<ul style="list-style-type: none">• Be aware of capacity of fuel tank and do not overfill.• Wear appropriate PPE while fueling.• Change clothing if saturated with fuel.	<ul style="list-style-type: none">• Inspect PPE daily.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators must have successfully completed a safe boating course.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

Water Sampling

Project Name: San Jacinto River Waste Pits	Project Number: 090557-01	JSA Number: 006	Issue Date: June 21, 2010
Location: San Jacinto River, Harris County, Texas	Contractor: Anchor QEA	Analysis by: Randy Brown	Analysis Date: June 10, 2010
Work Operation: Water Sampling	Superintendent/Competent Person: Jason Kase	Revised by: Chris Torell	Revised Date: June 16, 2010
Required Personal Protective Equipment (PPE): <ul style="list-style-type: none"> Modified Level D – safety glasses/splash goggles, steel toed boots, long pants, nitrile outer gloves and latex inner gloves, long sleeves if handling potentially contaminated media. U.S. Coast Guard-approved personal flotation device (PFD). Depending on activity, the following may also be required: hard hat, Tyvek coveralls, and hearing protection. 		Reviewed by: Chris Torell	Reviewed Date: June 16, 2010
		Approved by: Chris Torell	Approved Date: June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Water Sampling	Boating Hazards	<ul style="list-style-type: none"> Follow JSA 004 (Boat/Barge Activities) when working near or on the water. 	<ul style="list-style-type: none">
	Inhalation of contaminants Ingestion of contaminants Skin/eye contact with contaminated materials	<ul style="list-style-type: none"> Wear appropriate PPE. Contact 911, as necessary. If a person breathes in a large amount of organic vapor, move the exposed person to fresh air, rinse mouth. Perform CPR if breathing stops. If exposure to contaminated materials occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. Keep the affected person warm and at rest. 	<ul style="list-style-type: none"> Inspect PPE daily prior to use.

Water Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Sampling Activities	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of potentially slippery surfaces and tripping hazards. • Wear footwear that has sufficient traction to reduce risk of slipping. • Wear steel-toed rubber boots versus over-the-shoe rubber boots. • Work slowly during transit. Jumping, running, and horseplay are prohibited. • Proceed carefully on floating docks and ramps. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Clean up all spills immediately. • Notify the SSO of any unsafe conditions. 	<ul style="list-style-type: none"> • Routinely inspect work area for hazards.
	Dermal Exposure	<ul style="list-style-type: none"> • Wear appropriate PPE during sampling activities, including but not limited to protective gloves and safety glasses. 	<ul style="list-style-type: none"> • Inspect PPE daily prior to use.
	Noise Exposure	<ul style="list-style-type: none"> • Wear hearing protection in high noise areas or when working around heavy machinery or equipment (action level of 85 decibels [dBA] averaged over an eight-hour day). 	<ul style="list-style-type: none"> • Inspect PPE daily prior to use.
	Struck By / Pinch Points	<ul style="list-style-type: none"> • Maintain awareness of procedures underway and be attentive of sampling operations. 	<ul style="list-style-type: none"> •

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators

Water Sampling

must have successfully completed a safe boating course.

- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

Personal Decontamination

Project Name: San Jacinto River Waste Pits	Project Number: 090557-01	JSA Number: 007	Issue Date: June 21, 2010
Location: San Jacinto River, Harris County, Texas	Contractor: Anchor QEA	Analysis by: Randy Brown	Analysis Date: June 10, 2010
Work Operation: Personal Decontamination	Superintendent/Competent Person: Jason Kase	Revised by: Chris Torell	Revised Date: June 16, 2010
Required Personal Protective Equipment (PPE): <ul style="list-style-type: none"> Modified Level D – safety glasses/splash goggles, steel toed boots, and long pants. Depending on activity, the following may also be required: hard hat, nitrile outer gloves and latex inner gloves, long sleeves Tyvek coveralls, hearing protection, and U.S. Coast Guard-approved personal flotation device (PFD). Heat stress hazards will be considered when selecting PPE. 		Reviewed by: Chris Torell	Reviewed Date: June 16, 2010
		Approved by: Chris Torell	Approved Date: June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontaminate Personnel Exiting the Exclusion Zone	General	<ul style="list-style-type: none"> Use appropriate PPE to reduce exposure. Follow decontamination procedures as described in the site-specific Health and Safety Plan (HASP). Collect rinse water and used PPE and dispose per appropriate standard operating procedures described in the HASP. 	<ul style="list-style-type: none"> Inspect PPE daily prior to use.
	Site Hazardous Material Exposure	<ul style="list-style-type: none"> Training and safety awareness of potential exposure to chemicals of concern at the site and decontamination procedure. Review chemicals of concern. Wear appropriate PPE (e.g. Tyvek, nitrile gloves, safety glass, etc.). 	<ul style="list-style-type: none"> Inspect PPE daily prior to use.

Personal Decontamination

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of potentially slippery surfaces and tripping hazards. • Wear footwear that has sufficient traction to reduce risk of slipping. • Wear steel-toed rubber boots versus over-the-shoe rubber boots. • Work slowly during transit. Jumping, running, and horseplay are prohibited. • Proceed carefully on floating docks and ramps. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Clean up all spills immediately. • Notify the SSO of any unsafe conditions. 	<ul style="list-style-type: none"> • Routinely inspect work areas for hazards.
	Heat Stress (see HASP Section 12.2)	<ul style="list-style-type: none"> • Adjust work schedules, as necessary. • Perform work during cooler hours of the day if possible or at night if possible and if adequate lighting can be provided. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat related illness. 	<ul style="list-style-type: none"> • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators must have successfully completed a safe boating course.

Personal Decontamination

- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

Tool and Equipment Decontamination

Project Name: San Jacinto River Waste Pits	Project Number: 090557-01	JSA Number: 008	Issue Date: June 21, 2010
Location: San Jacinto River, Harris County, Texas	Contractor: Anchor QEA	Analysis by: Randy Brown	Analysis Date: June 10, 2010
Work Operation: Tool and Equipment Decontamination	Superintendent/Competent Person: Jason Kase	Revised by: Chris Torell	Revised Date: June 16, 2010
Required Personal Protective Equipment (PPE): <ul style="list-style-type: none"> Modified Level D – safety glasses/splash goggles, steel toed boots, long pants, hard hat, nitrile outer gloves and latex inner gloves, and Tyvek coveralls. Personal flotation device (PFD) if decontamination performed over water. 		Reviewed by: Chris Torell	Reviewed Date: June 16, 2010
		Approved by: Chris Torell	Approved Date: June 22, 2010

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontaminate tools and equipment in accordance with site-specific Health and Safety Plan	Site Hazardous Material Exposure	<ul style="list-style-type: none"> Training and safety awareness of potential exposure to chemicals of concern at the site and decontamination procedure. Review chemicals of concern. Follow appropriate decontamination procedures. Wear appropriate PPE (e.g. Tyvek, nitrile gloves, safety glass, etc.). 	<ul style="list-style-type: none"> Inspect PPE daily prior to use.
	Heat Stress (see HASP Section 12.2)	<ul style="list-style-type: none"> Adjust work schedules, as necessary. Perform work during cooler hours of the day if possible or at night if possible and if adequate lighting can be provided. Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. Maintain body fluids at normal levels. Train workers to recognize the symptoms of heat related illness. 	<ul style="list-style-type: none"> Monitor workers' physical conditions. Monitor outside temperature versus worker activity.

Tool and Equipment Decontamination

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of potentially slippery surfaces and tripping hazards. • Wear footwear that has sufficient traction to reduce risk of slipping. • Wear steel-toed rubber boots versus over-the-shoe rubber boots. • Work slowly during transit. Jumping, running, and horseplay are prohibited. • Proceed carefully on floating docks and ramps. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Clean up all spills immediately. • Notify the SSO of any unsafe conditions. 	<ul style="list-style-type: none"> • Routinely inspect work area for hazards.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to initial 40-hour, 8 hour Supervisor and annual 8-hour refresher training. All boat operators must have successfully completed a safe boating course.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120 (f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their Supervisor during their Daily Safety Meeting.

APPENDIX G

HYDRODYNAMIC MODELING

TIME CRITICAL REMOVAL ACTION

SAN JACINTO RIVER WASTE PITS

SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

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LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
ADCP	acoustic doppler current profiler
CM	centimeters
CFS	cubic feet per second
DEMs	digital elevation models
EFDC	environmental fluid dynamics code
MHHW	mean higher high water
MHW	mean high water
MLLW	mean lower low water
MSL	mean sea level
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
RMS	root-mean-square
Site	San Jacinto River Waste Pits Superfund Site
TCRA	time-critical action removal
USACE	U.S. Army Corp. of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey

1 INTRODUCTION

The San Jacinto River Waste Pits Superfund Site (Site) is located on the western bank of the San Jacinto River, in Harris County, Texas. The Site occupies a 20 acre tract of land immediately north of the Interstate Highway 10 Bridge. The Site is bounded on the south by Interstate Highway 10, on the east by the San Jacinto River main channel, and on the north and west by shallow waters off the river's main channel as shown in Figure 1. A Time-Critical Removal Action (TCRA) will be implemented at the Site to control sediment erosion. The purpose of this report is to describe the development of the hydrodynamic model which was used to predict current velocity and water depths for use in the design of the granular cover materials for the TCRA. This report also presents the methodology that was used to assess the size of the granular cover materials to be used as a cap in the TCRA.

2 DESCRIPTION OF TECHNICAL APPROACH

The technical approach involved the development and calibration of a hydrodynamic model for the Lower San Jacinto River that may be used as a diagnostic tool to address questions concerning remedial alternatives for the Site. The hydrodynamic model used in this study is the Environmental Fluid Dynamics Code (EFDC), which is approved and supported by the U.S. Environmental Protection Agency (USEPA). EFDC is a general purpose hydrodynamic model capable of simulating flow in rivers, lakes, reservoirs, estuaries, and coastal oceans. The model solves the conservation of mass and momentum equations, which are the fundamental equations governing the movement of water in a river or lake. Anchor QEA, LLC has applied EFDC to simulate the hydrodynamics in many similar tidal rivers, including the Lower Duwamish River (Seattle, Washington), the Lower Willamette River (Portland, Oregon), and Patrick's Bayou (Deer Park, Texas). A characteristic of EFDC that is of importance for this study is the wetting-drying feature, which makes it possible to realistically simulate the flooding and drying of the intertidal areas. It also allows for the simulation of the inundation of the waste pits during high-flow events. For this study, the model was used in two-dimensional, vertically-averaged mode, which provides for a conservative estimate of the bottom current velocities and shear stresses in the study area. A complete description of EFDC is given in Hamrick (1992).

The first step of the study was to develop and calibrate the hydrodynamic model. Field studies were conducted to collect data to support the modeling effort, including: high-resolution contour lines collected in 2009 and 2010 representing the bathymetry and topography in the study area and an acoustic doppler current profiler (ADCP) study collected in June and July 2010 where depth-averaged current velocity and stage height were collected at a single location in the vicinity of the study area. The current velocity and stage height were used to calibrate the hydrodynamic model.

After calibration of the hydrodynamic model was completed, high-flow event simulations were conducted to understand under what conditions the waste pits were inundated and understand the velocity forces to aid in the design of the cover material for the TCRA. Specifically, the 5-year, 10-year, and the 100-year high-flow event were evaluated as the design criteria for the study area. Because of the uncertainty of the downstream tidal elevation during the high-flow events, bounding simulations were performed, representing lower- and upper-bound stage height scenarios. The existing condition bathymetry used during model calibration was also used to evaluate the waste pit area for the TCRA.

The primary objective of the cover material is to prevent exposure and erosion of the materials located on the Site while the non-TCRA is being designed and implemented. The cover material was designed using methods developed by the USEPA and the U.S. Army Corps of Engineers (USACE) and presented in “Armor Layer Design of Guidance for In-Situ Subaqueous Capping of Contaminated Sediments” (Maynord 1998).

3 HYDRODYNAMIC MODEL DEVELOPMENT

The model domain for this study extends from about 12 miles downstream of the Lake Houston Dam to the confluence of the San Jacinto River and the Houston Ship Channel, for a total of approximately 7 miles of river. The 2007 Merged Shoreline from the National Oceanic and Atmospheric Administration’s (NOAA’s) Office of Coast Survey was used as the river shoreline and assigned to the mean high water (MHW) elevation of 0.175 m mean sea level (MSL). The geometry and bathymetry were represented in the model using variable rectangular cell sizes. The grid cell resolution is 15 x 15 meters (m) in the vicinity of the waste pits and gradually increases to 30 x 30 m farther from the study area. This resolution

was found adequate for the objectives of the modeling study. It represents a balance to adequately simulate hydrodynamic processes and the ability to conduct long-term, multi-year simulations in the future, within a practical processing time for the model.

Model bathymetry and topography used to define existing conditions was obtained from four different sources. Bathymetry outside of the study area was defined from National Ocean Service (NOS) Hydrographic Survey sounding data collected in 2004 within the shoreline. Sounding data consisted of single-beam bathymetric data perpendicular to the channel in variable spacing and transect separation widths, as well as several transects parallel to the river along the navigation channel. Topography outside of the study area was delineated using 10 m resolution digital elevation models (DEMs) from the United States Geological Survey (USGS). Bathymetry and topography inside the study area was defined from two sources representing high resolution contour lines collected in 2009 and 2010. The 2009 survey collected data around a radius of 0.1 miles from the waste pits. The 2010 survey collected data 0.6 miles upstream and 0.2 miles downstream of the waste pits. The more recent 2010 data was used in lieu of the 2009 data, when available. All the data was converted and represented in the MSL vertical datum. The sounding, contour, and DEM data were combined and interpolated in ArcGIS to create a surface map of the bathymetry and topography in the model domain and projected to the numerical grid. A maximum topographic elevation of +7 m MSL was selected to define the conservative maximum inundation level of the flood plain during the high-flow events. Thus, a total of approximately 32,400 active horizontal cells were modeled. Figure 2 and 3 show the numerical grid and projected bathymetry for the entire domain and study area, respectively.

The model has two boundary conditions that need to be specified: 1) upstream inflow near the Lake Houston Dam; and 2) downstream water level (tidal elevation) for the confluence between the San Jacinto River and the Houston Ship Channel. Flow rate data was available at the Lake Houston Dam from the Coastal Water Authority for a 3-year period between 2007 and 2009 (Mike Kent, personal communication, January 2010). To develop a longer term period of the historical flow record, daily average flow rates at the Dam were estimated for the 25-year period between 1985 and 2009. The flow rates were estimated by summing up the flow data from the seven upstream USGS gages and prorating the summed flow by the

ratio of the drainage area at the Dam (2,828 square miles, mi²) to the sum of the drainage areas of the seven upstream gages (2,075 mi²). This represents a proration factor of about 1.4. A list of the USGS gages used and the corresponding drainage areas are shown in Table G-1.

Table G-1
List of USGS Streamflow Gage Locations and Corresponding Drainage Areas Used to Estimate the Long-Term Historical Flow Rate at the Lake Houston Dam

USGS Gage Number	Location Name	Drainage Area (mi ²)
08071280	Luce Bayou above Lake Houston near Huffman, TX	218
08070200	East Fork San Jacinto River near New Caney, TX	388
08070500	Caney Creek near Splendora, TX	105
08068090	West Fork San Jacinto River above Lake Houston near Porter, TX	962
08069000	Cypress Creek near Westfield, TX	285
08068500	Spring Creek near Spring, TX	117

The location of each of the USGS gage stations are shown on the map in Figure 4. A comparison of the daily average flow rates between the estimated values and actual values from the Dam was performed for the common period between 2007 and 2009. Figure 5 shows a one-to-one plot of the flow rates in the top panel and cumulative frequency distribution comparison in the bottom panel. This analysis indicates that the two records are reasonably similar.

Inflows at the upstream boundary during high-flow events were specified based on the results of a flood frequency analysis. A Log-Pearson Type 3 flood frequency analysis (Helsel and Hirsch 2002) of daily-average flow rate data from the estimated 25-year long-term historical record was conducted. The Log-Pearson Type 3 analysis is the recommended technique for flood frequency analysis (IACWD 1982). The results of this analysis are presented on Figure 6, which show flow rates for return periods between 2- and 100-years. As required by USEPA in the decision document (USEPA 2010), the 5-year, 10-year, and 100-year high-flow events were used for the design of the cover system. The 100-year flood

is approximately 372,000 cubic feet per second (cfs). Flows of this magnitude have occurred in the San Jacinto River. For example, on October 19, 1994, a flow rate of 356,000 cfs was measured in the San Jacinto River near Sheldon, Texas, which was estimated to exceed the 100-year flow rate, according the United States Geological Survey (USGS 1995).

The water surface elevation at the downstream boundary was obtained from two nearby NOAA tidal gage stations as shown in Figure 7. The NOAA tidal gage station 8770743 (Battleship Texas State Park, Texas) is the closest, located on the Houston Ship Channel, within a mile of the confluence with the San Jacinto River. Long-term historical hourly measured data is only available for the month of September 2005 from this gage. A 15-day subset of this period was used for the high-flow event simulations. To incorporate the uncertainty in the tidal elevation during high-flow events, a bounding calculation was performed. The upper-bound stage height conditions were estimated as the base case stage height plus the difference between the mean higher high water (MHHW) and mean sea level at this location. This represents an increase of 0.67 feet. The lower-bound stage height conditions were estimated as the base case stage height minus the difference between the mean lower low water (MLLW) and mean sea level. This represents a decrease of 0.79 feet. The base case, lower-bound, and upper-bound stage height conditions are shown in Figure 8. Tidal data used during the calibration period was obtained from another nearby location, NOAA gage station 8770613 (Morgans Point, Texas). This station is located approximately 12 miles southeast of the Battleship State Park gage station. Measured hourly stage height data is available at this location for the 18-year period between 1993 and 2010. To ensure that the tidal elevations from the two stations are similar, a comparison was made for the September 2005 period, as shown in Figure 9.

4 CALIBRATION APPROACH AND RESULTS

Calibration of the hydrodynamic model was achieved using ADCP data collected in the main channel, adjacent to the study area. The ADCP data consisted of water surface elevation, depth-averaged current velocity data, and east-west and north-south components of velocity collected in two minute intervals during the 21-day period between June 16 and July 6, 2010. The ADCP location, shown in Figure 10, was selected because of accessibility from the study area and because the location was totally submerged during the entire calibration period.

The upstream inflow and downstream tidal elevation for the calibration period is shown in Figure 11. During the calibration period, total freshwater inflow in the river had a maximum peak value of about 21,000 cfs, which corresponds to a high-flow event with a return period of approximately 1.3 years. The model parameter that was adjusted to achieve the optimum agreement between predicted and observed water surface elevation and current velocity was the effective bed roughness (z_0) in the hydrodynamic model, which represents the total roughness due to form drag and skin friction. Generally, z_0 ranges from about 0.1 to 10 centimeters (cm).

A value of 0.1 cm for total effective bed roughness produced the best agreement between observed and predicted water surface elevation and depth-averaged current velocity during the calibration period (Figure 12). Overall the results from the calibration indicate that the hydrodynamic model is able to adequately simulate the water surface elevation and current velocity in the San Jacinto River for a wide range of freshwater inflow and tidal conditions. The average absolute and root-mean-square (RMS) errors for the water surface elevation and current velocity during the calibration period are listed in Table G-2.

Table G-2
Results of Error Analysis for Hydrodynamic Model Calibration Period

Model Output	Average Absolute Error	RMS Error
Water surface elevation (ft)	0.11	0.15
Current velocity (cm/s)	8.6	11

5 EVALUATION OF TCRA REMEDIAL SCENARIO

After successful calibration of the model, high-flow event hydrodynamic simulations were conducted using the current condition bed elevations as shown in Figure 3. Predicted current velocities within the study area were used to calculate the median particle diameter (D_{50}) for the cover material.

Using a constant upstream flow rate, the 5-year, 10-year, and 100-year high-flow events were simulated for a 15-day period in September 2005 using the upper- and lower-bound

tidal elevations. Results indicated that the lower-bound tidal elevations provided a more conservative prediction of the maximum current speeds within the study area. Figures 13, 14, and 15 show the spatial distribution of the predicted maximum current speeds in the study area during each event.

The method presented in Maynard (1998) is based on the USACE's "Hydraulic Design of Flood Control Channels" (USACE 1994). This method uses velocity and flow depth computed by the depth-averaged hydrodynamic model to determine the size of the granular cover material that will be stable for a given current velocity.

Equation 2 from Maynard (1998) is:

$$D_{50} = S_f C_s C_v C_T C_G d \left[\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{\frac{1}{2}} \frac{V}{\sqrt{K_1 g d}} \right]^{2.5}$$

Where

- D_{50} = median particle size in feet
- S_f = safety factor
- C_s = stability coefficient for incipient failure
- C_v = velocity distribution coefficient
- C_T = blanket thickness coefficient
- C_G = gradation coefficient = $(D_{85}/D_{15})^{1/3}$
- D_{85}/D_{15} = gradation uniformity coefficient
- d = water depth in feet (from the hydrodynamic model)
- γ_s = unit weight of stone
- γ_w = unit weight of water
- V = maximum depth-averaged velocity in feet per second (from the hydrodynamic model)
- K_1 = side slope correction factor
- g = acceleration due to gravity

Figure 16 presents the computed maximum stable particle size in each model grid cell over the Site for all events simulated.

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FIGURES

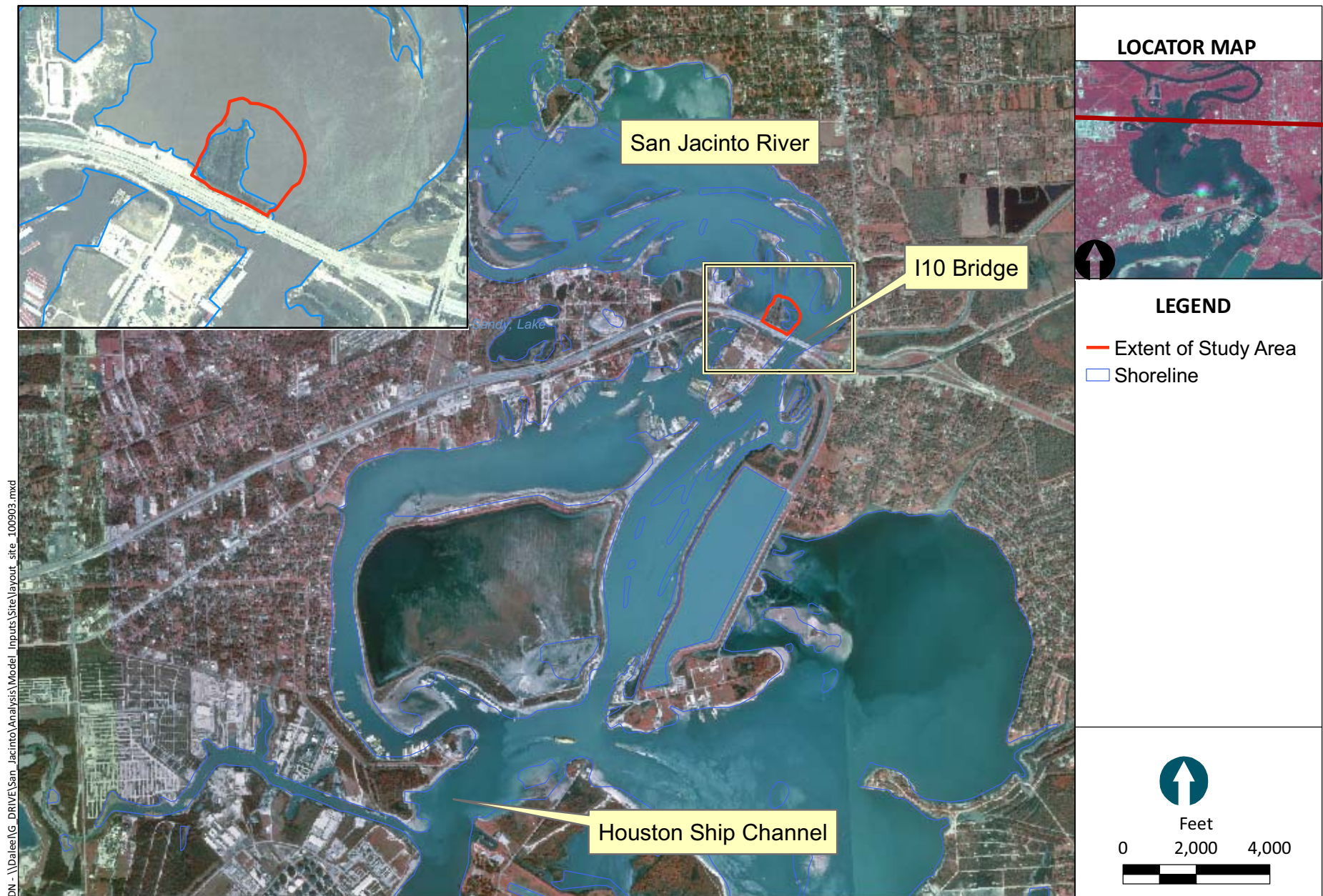
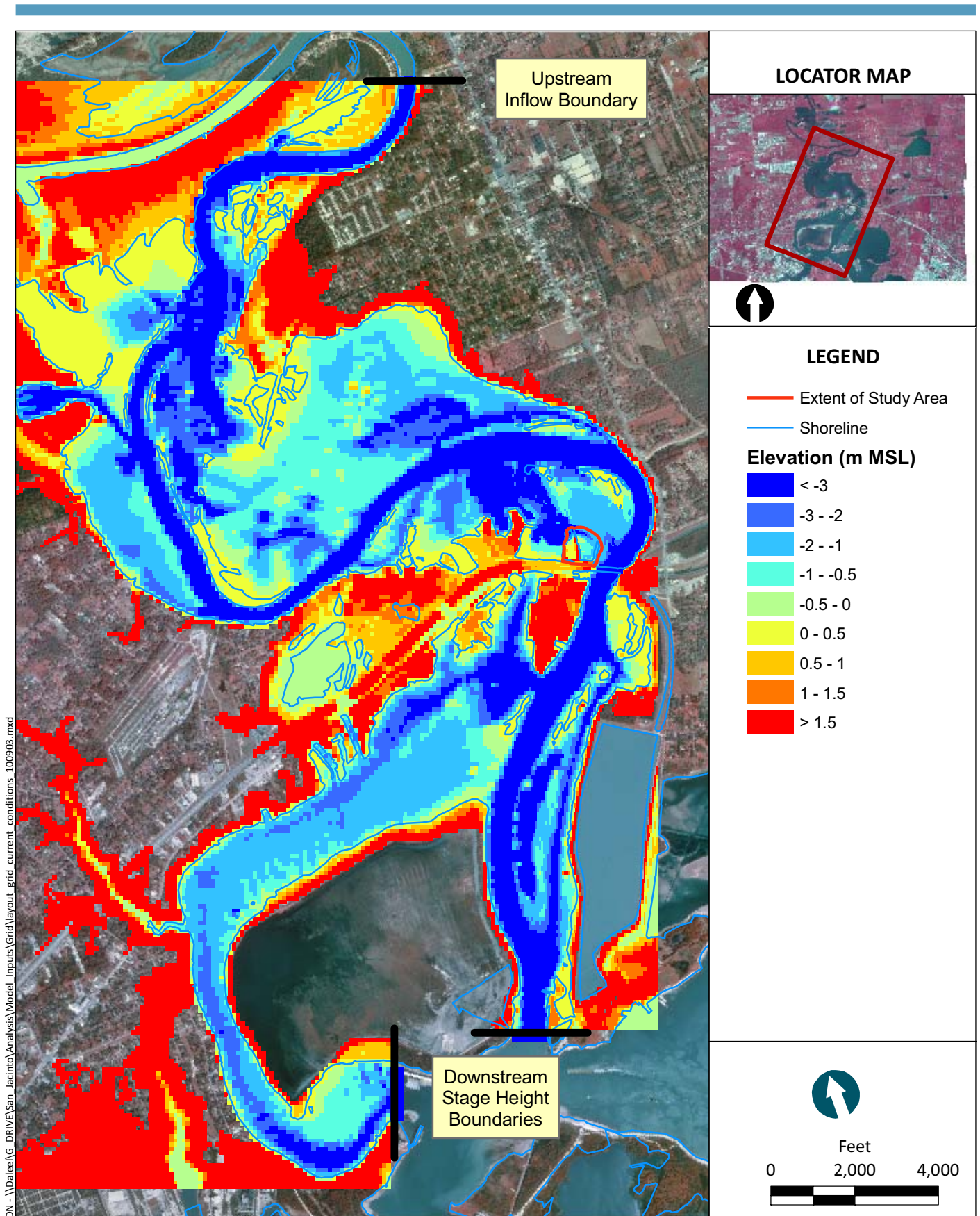
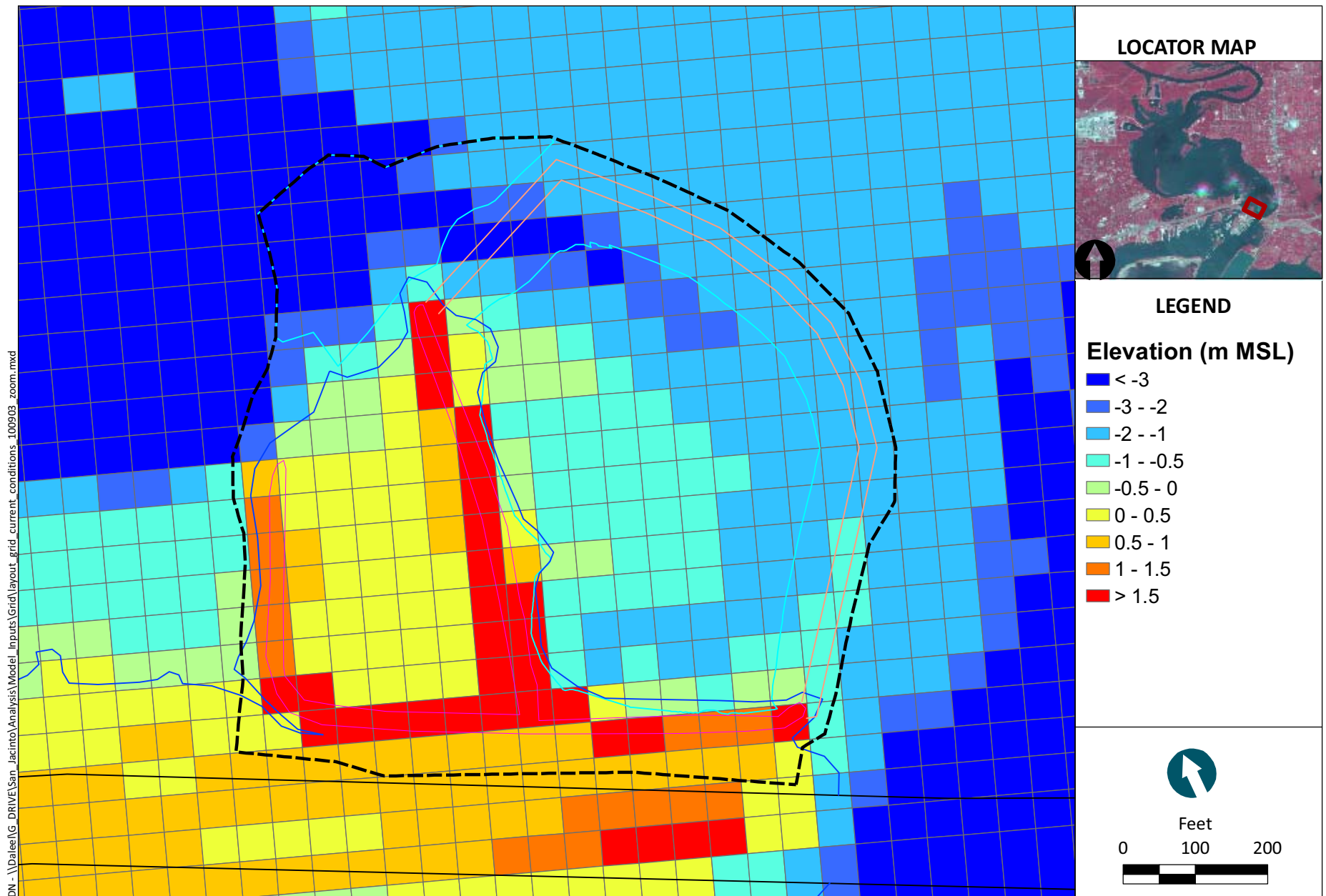


Figure 1
San Jacinto River Waste Pits Superfund Site
San Jacinto River Study Area





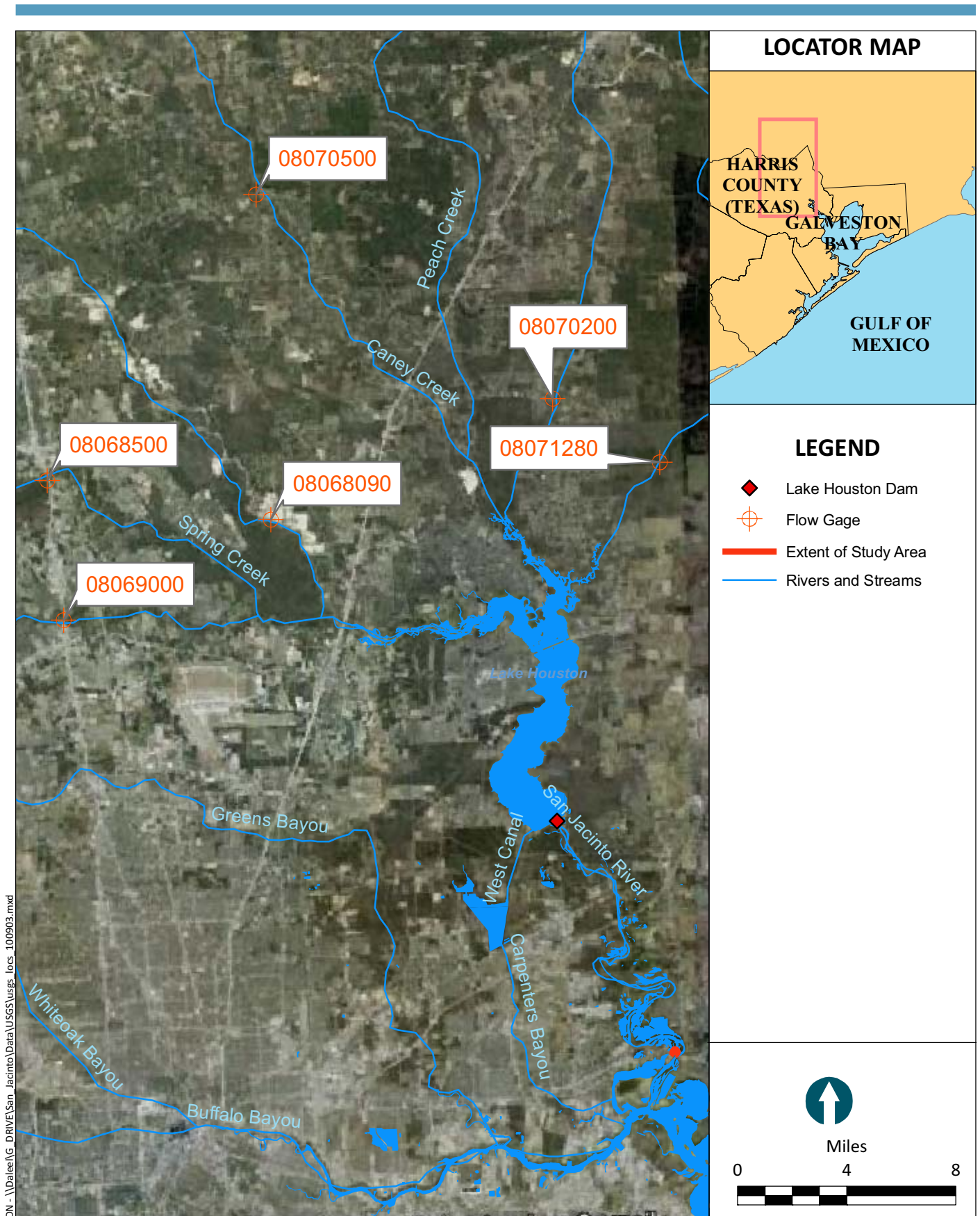


Figure 4

Locations of USGS Gage Stations Used to Estimate Long-Term Historical Flow at the Lake Houston Dam
San Jacinto River Study Area

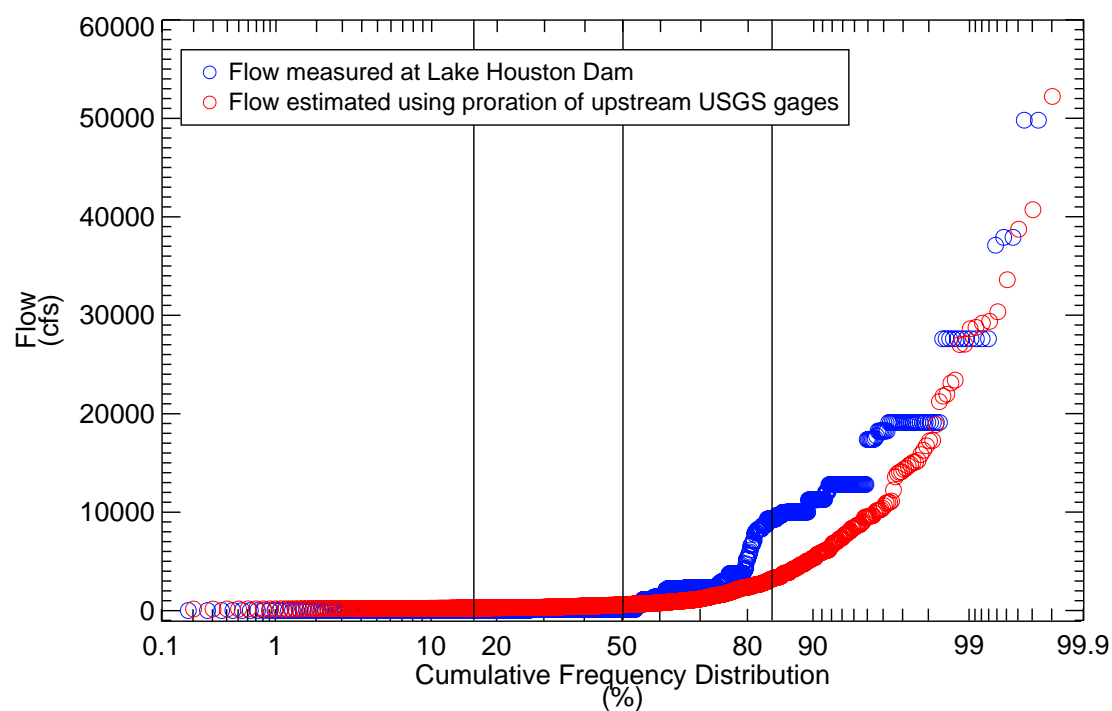
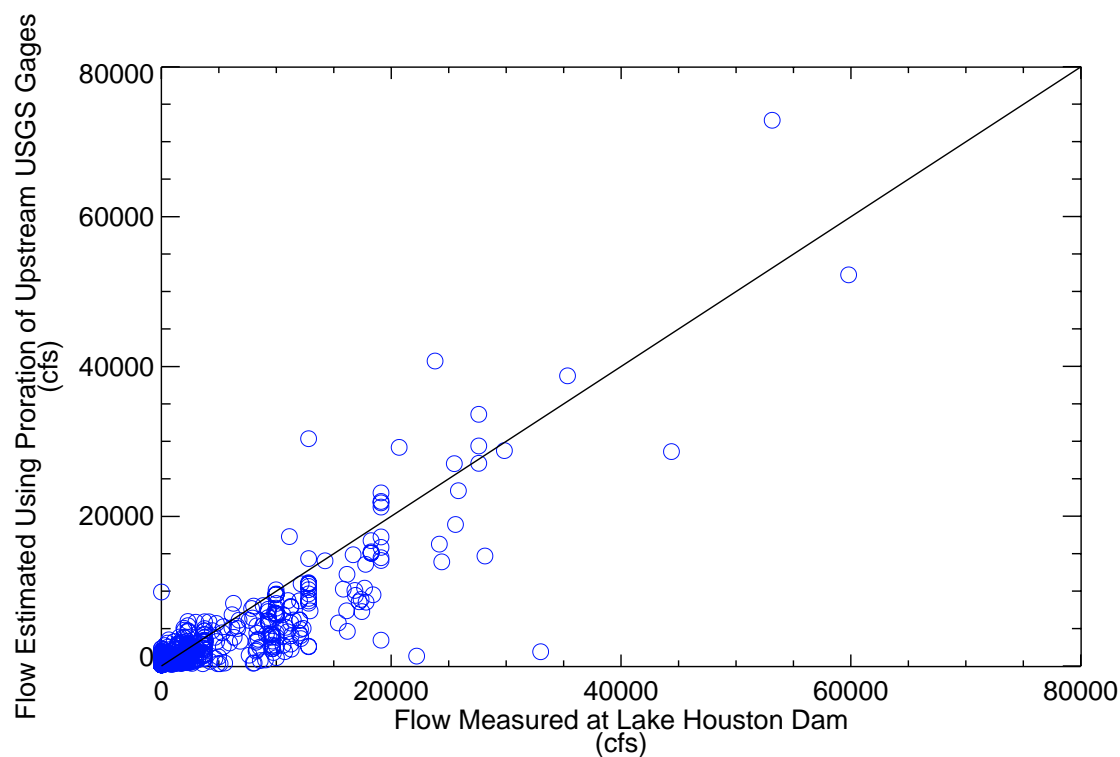


Figure 5

Comparison of Historical Daily-Average Flow Rate at the Lake Houston Dam and the Estimated Flow Rate from the Six Upstream USGS Gages San Jacinto River Study Area



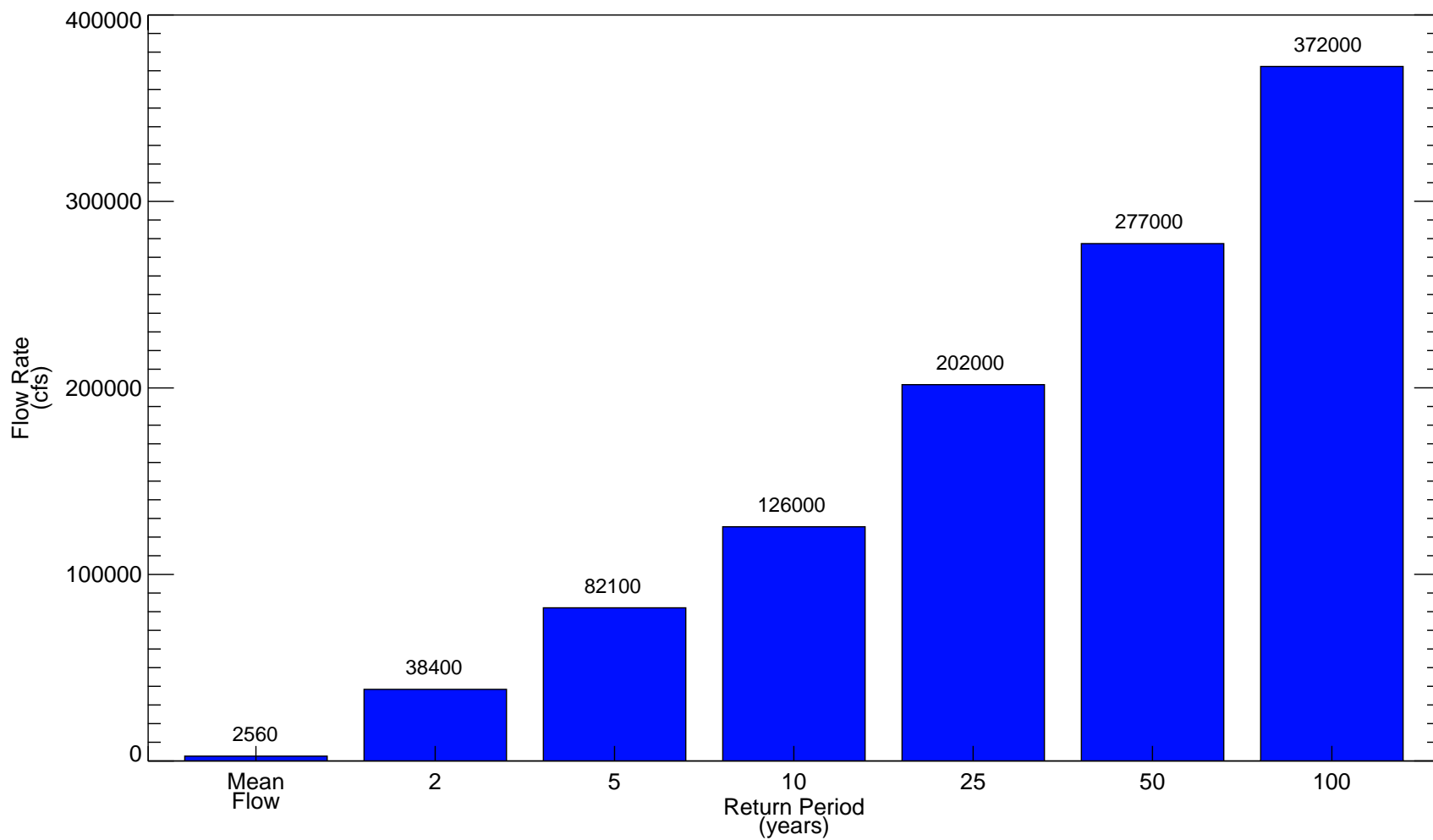
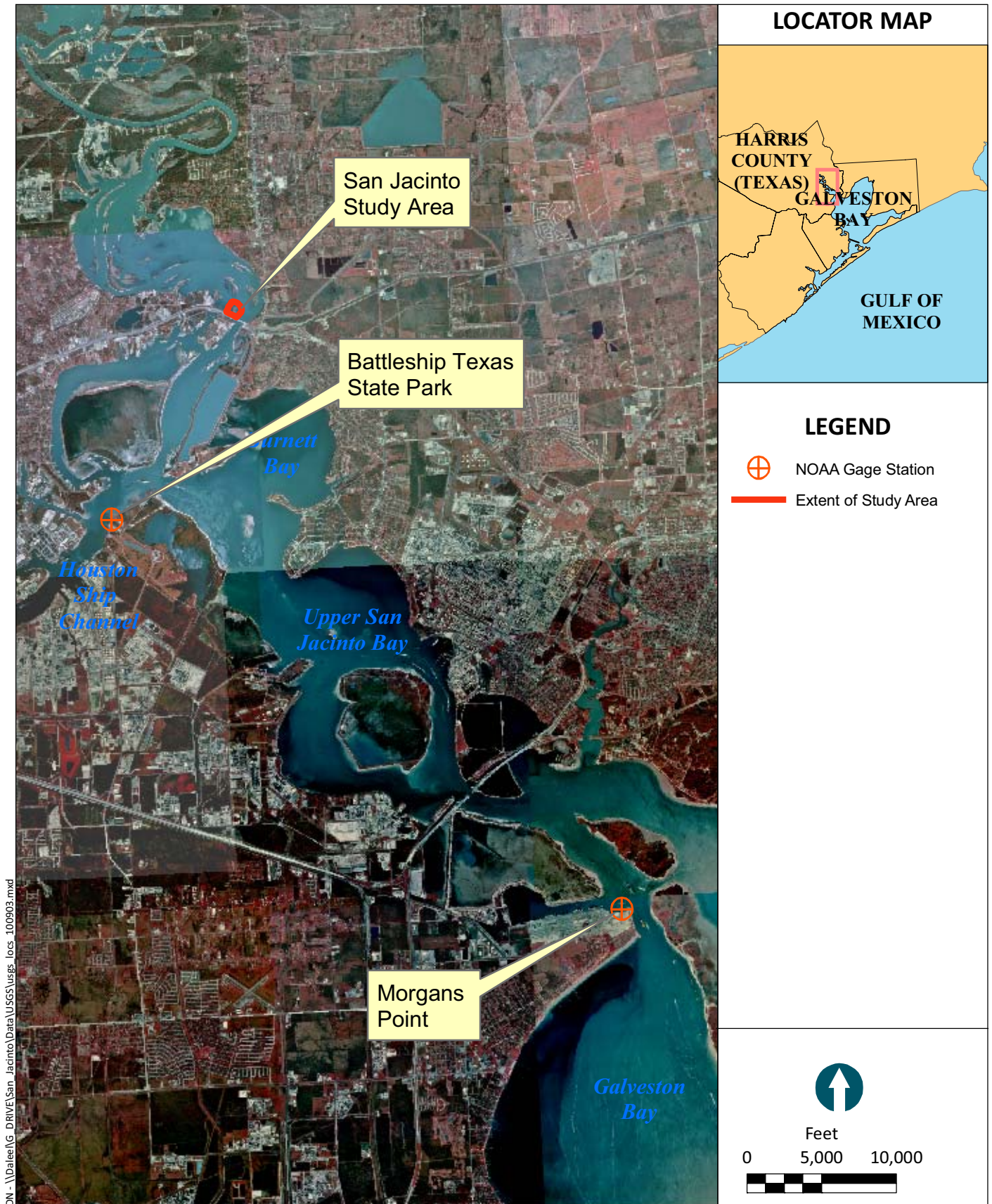


Figure 6

Flood Frequency Analysis for Lake Houston, Using Sum of Flows at Upstream USGS Gages
San Jacinto River Study Area





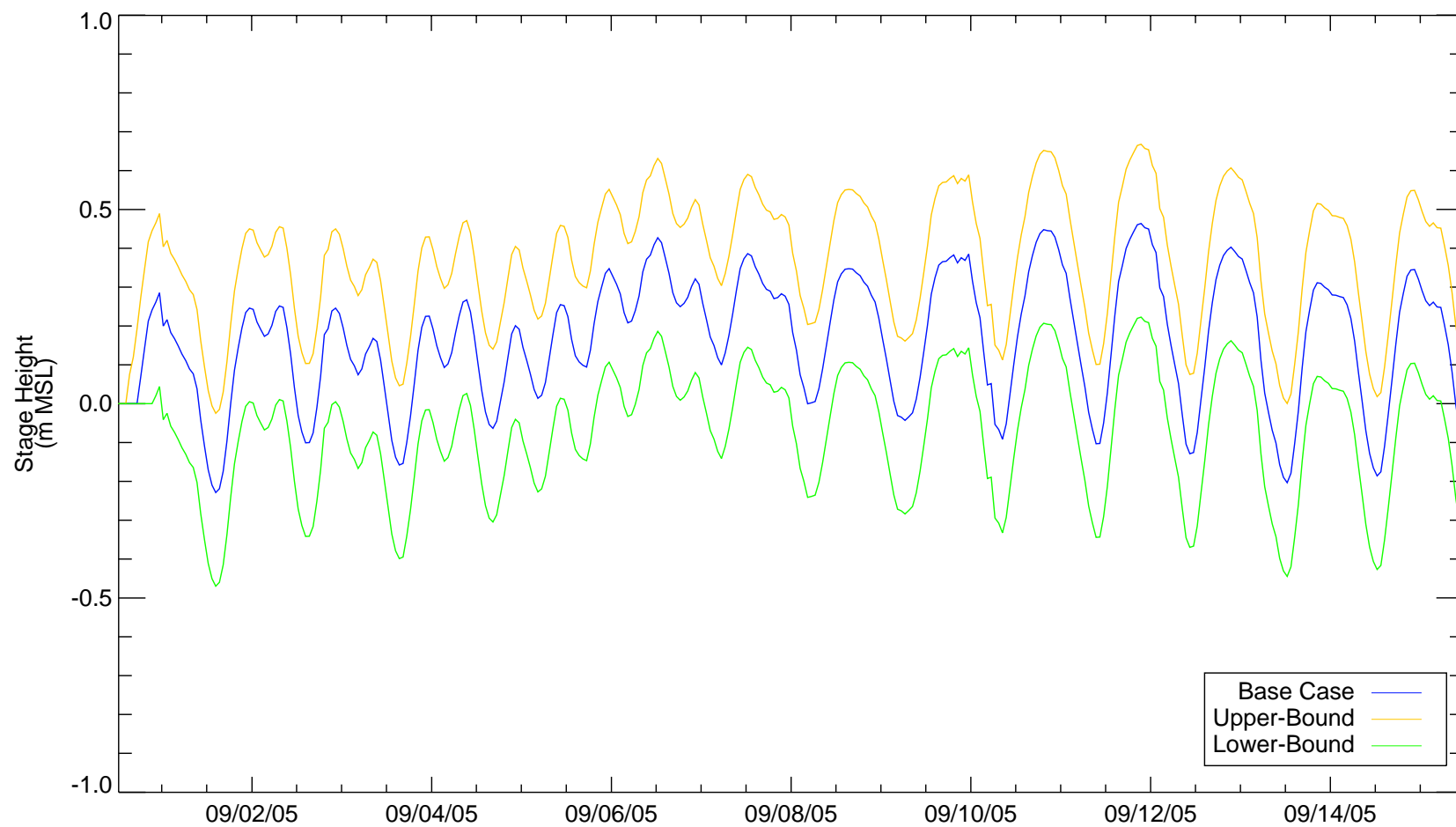


Figure 8

Base Case, Lower-Bound, and Upper-Bound Stage Height Conditions for 15-Day Period
in September 2005 Used in the High-Flow Event Simulations
San Jacinto River Study Area



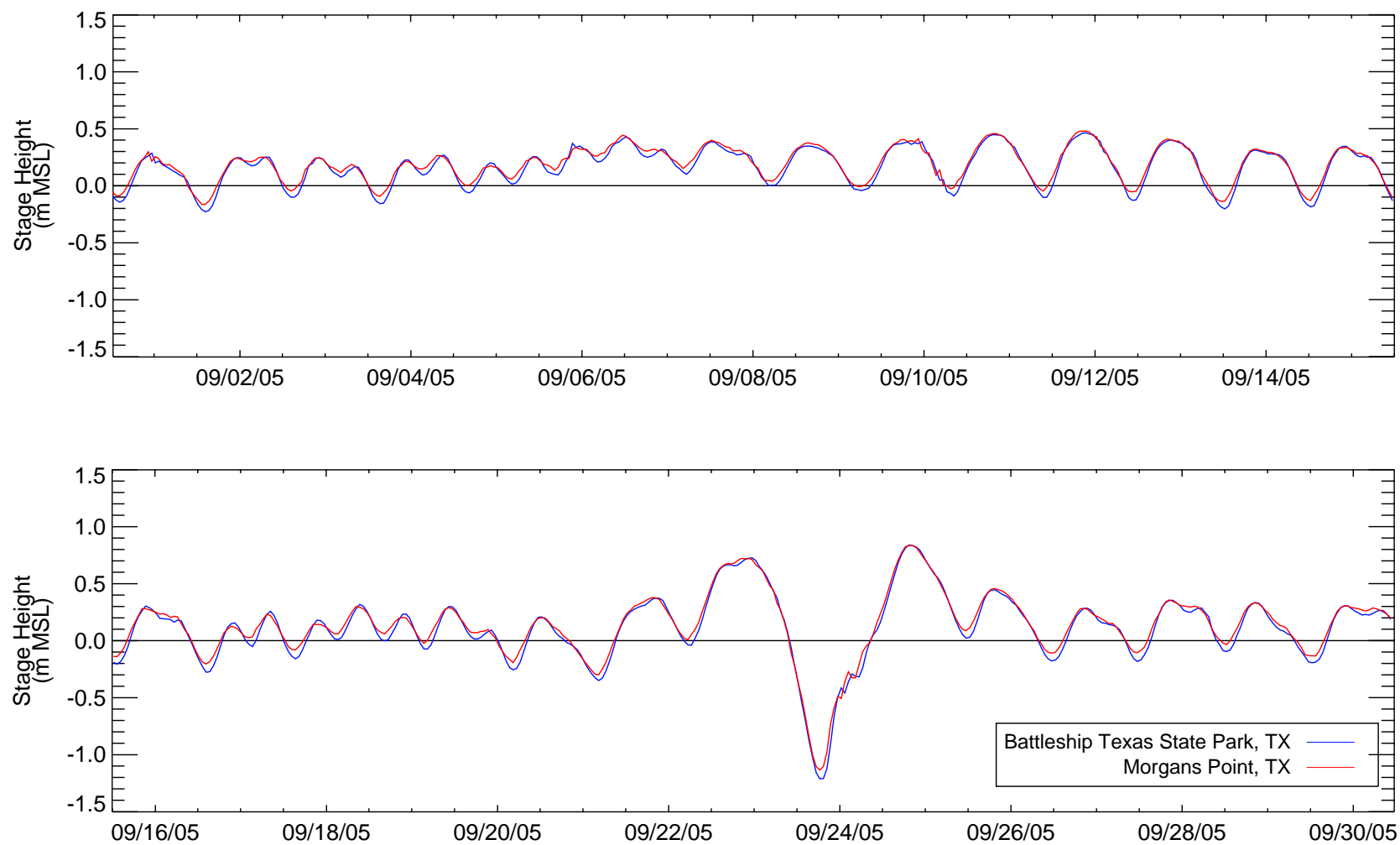


Figure 9

Comparison of Measured Stage Height at Battleship Texas State Park, TX and
Morgans Point, TX During September 2005
San Jacinto River Study Area



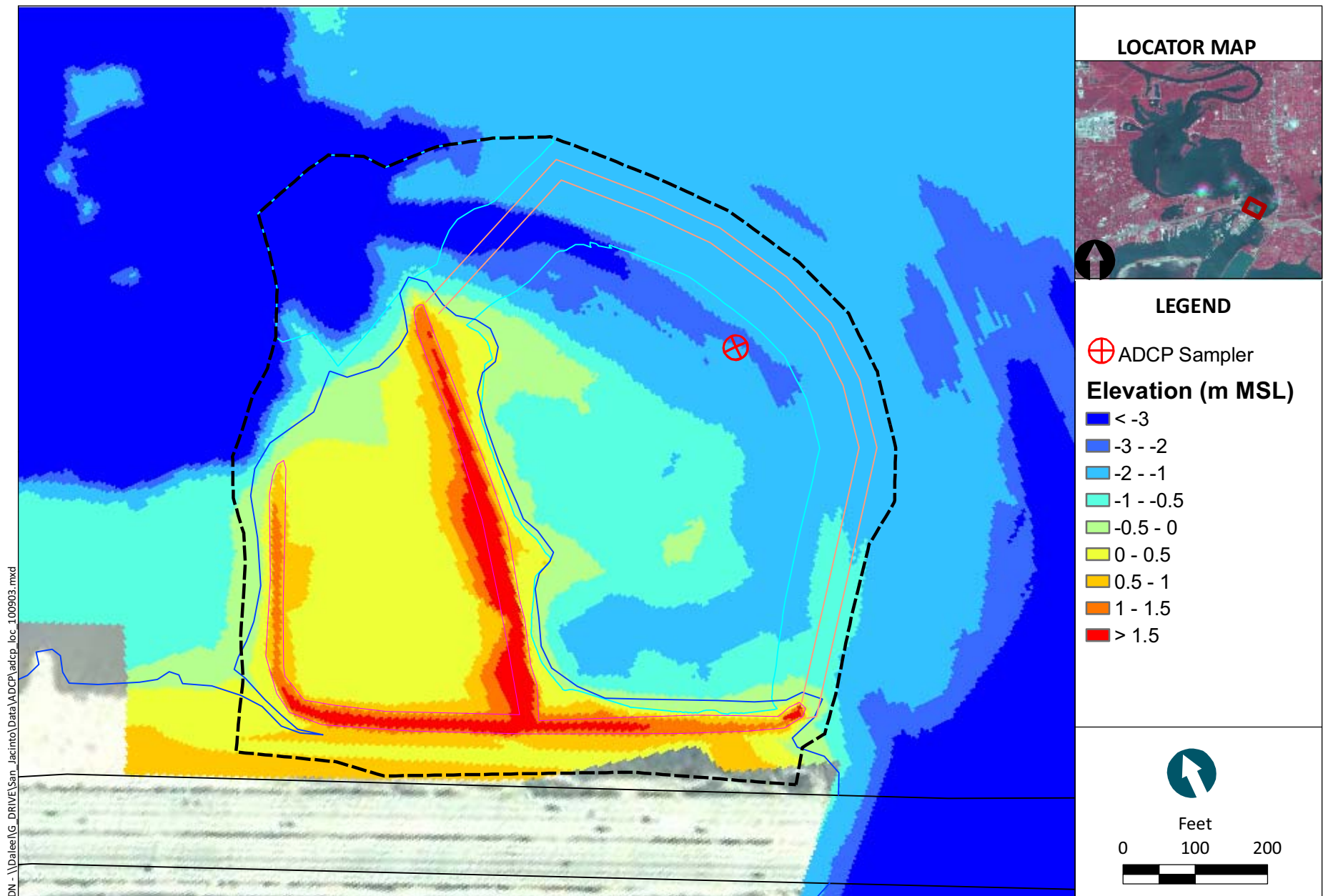


Figure 10
Location of ADCP Sampler During the Calibration Period
San Jacinto River Study Area

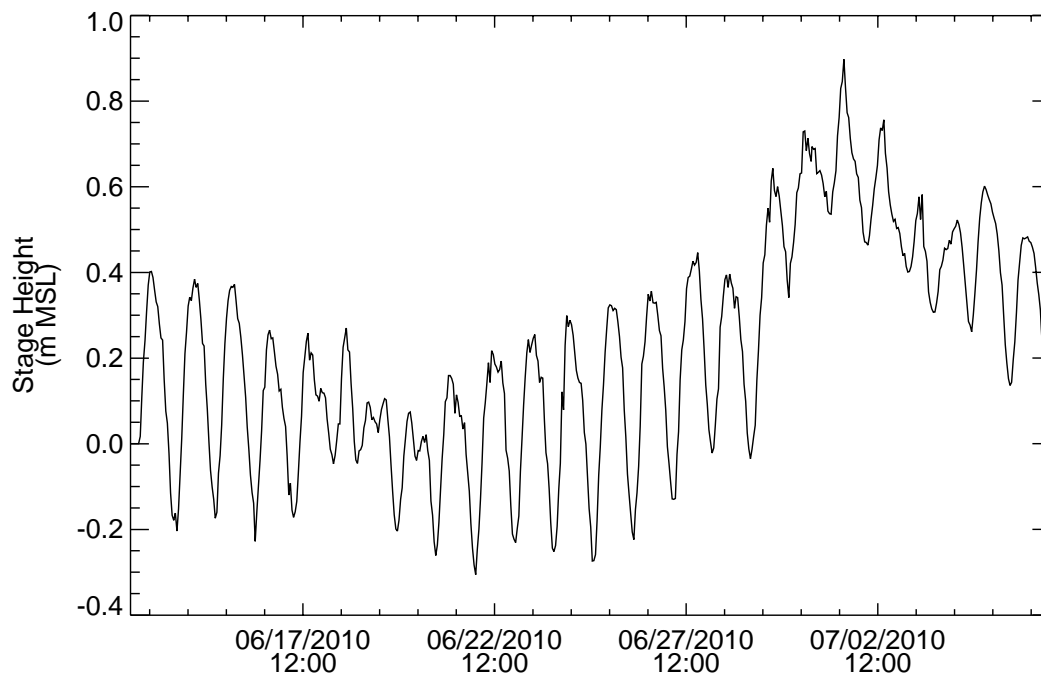
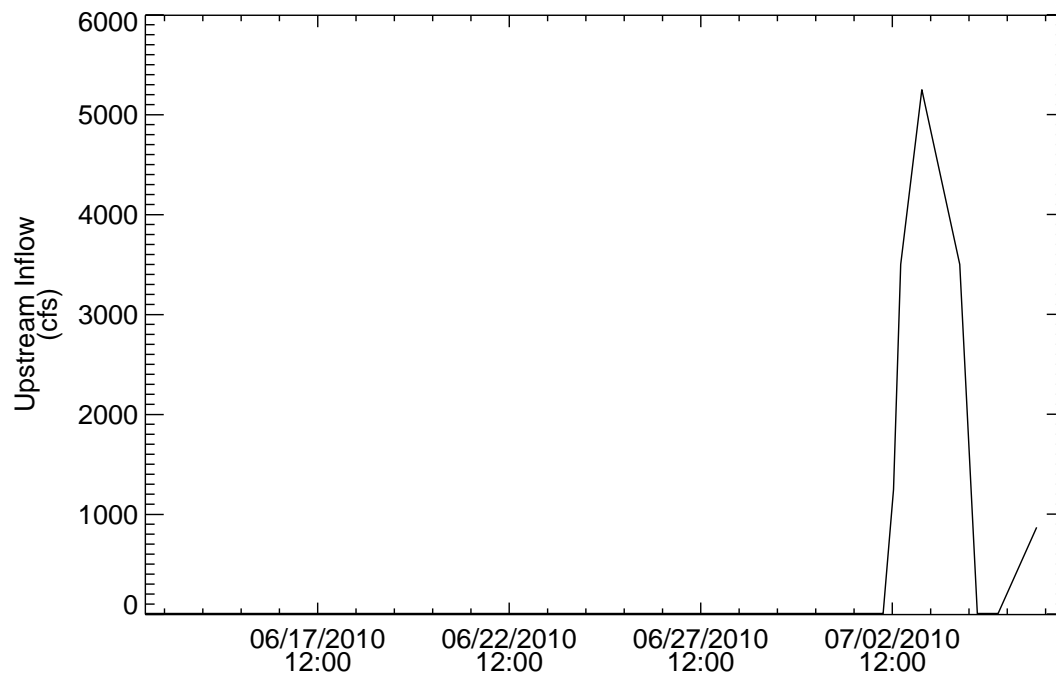


Figure 11

Upstream Inflow and Downstream Stage Height During the Calibration Period
San Jacinto River Study Area



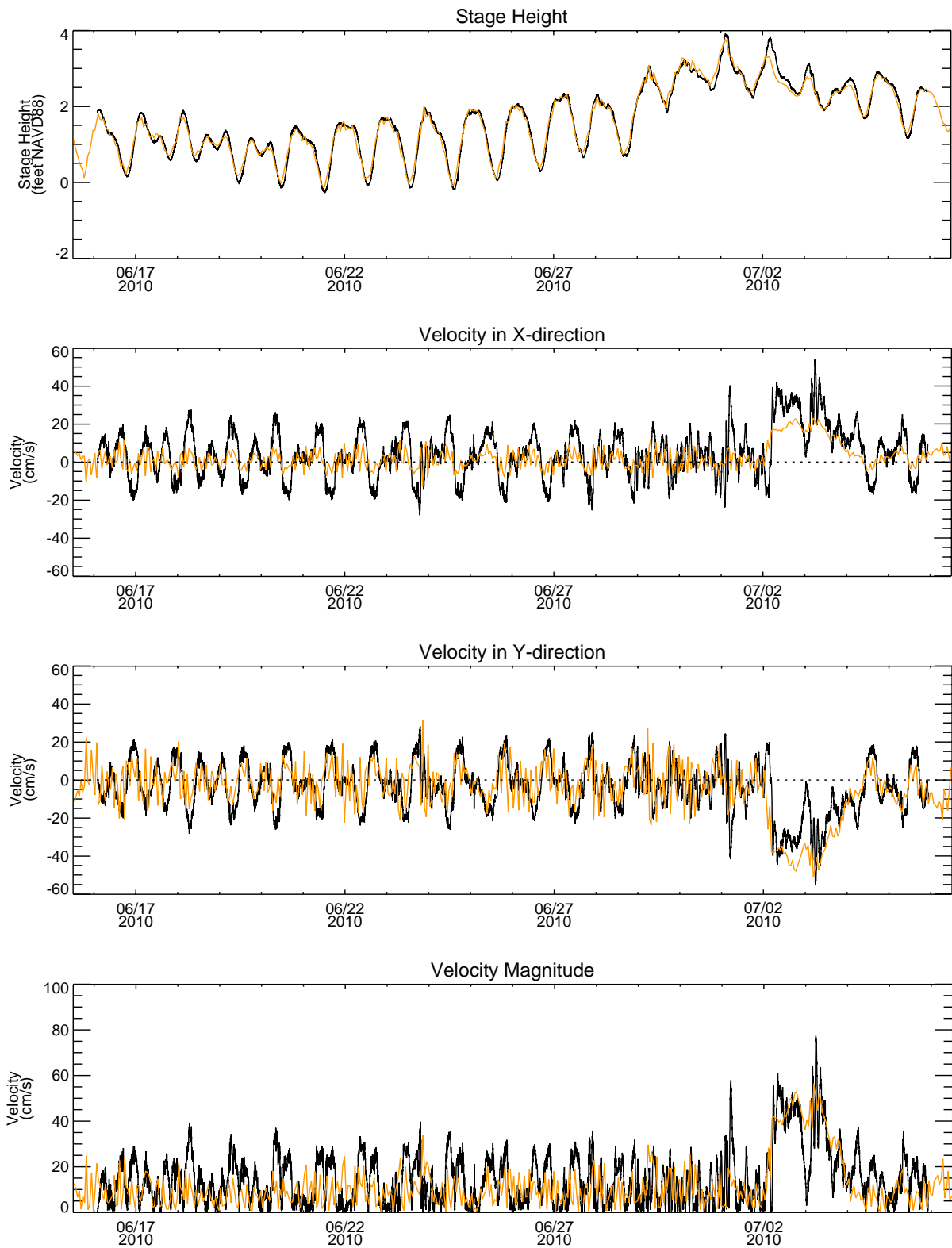


Figure 12

Model-Data Comparison of Water Surface Elevation
and Depth-Averaged Current Velocity During
June/July 2010 Calibration Period
San Jacinto River Study Area



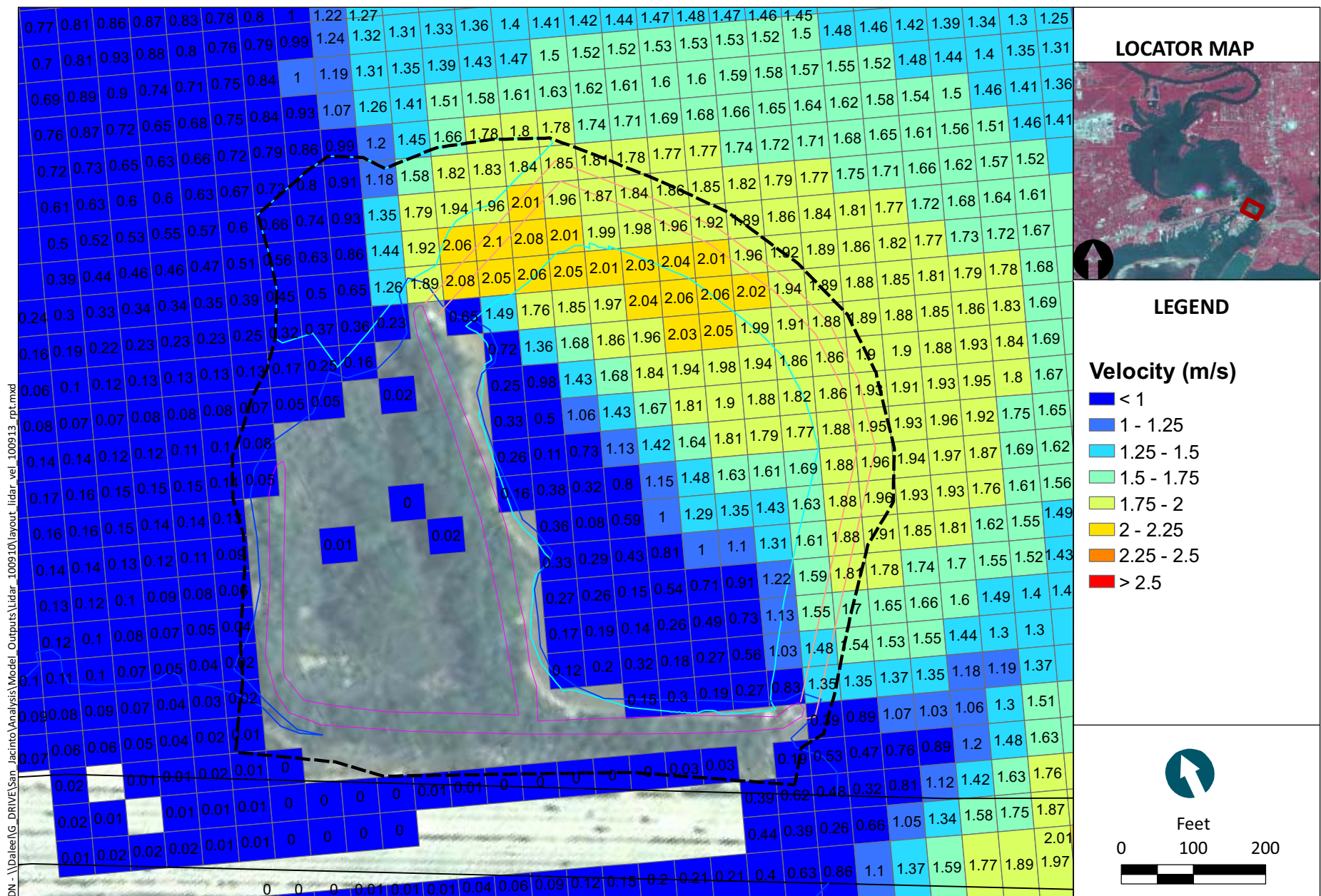


Figure 13
Spatial Distribution of Maximum Current Speeds During the 5-Year High-Flow Event
San Jacinto River Study Area

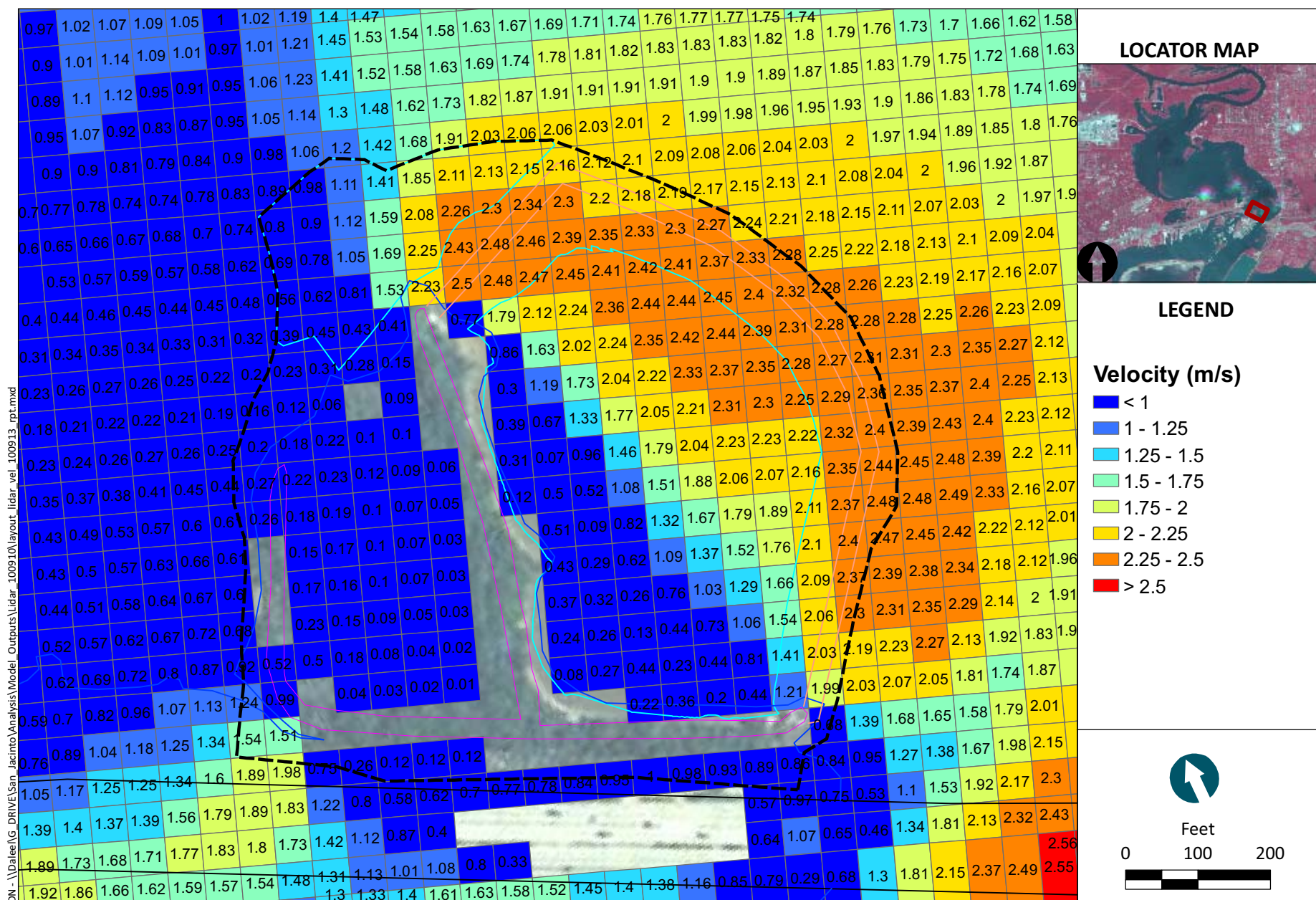


Figure 14
Spatial Distribution of Maximum Current Speeds During the 10-Year High-Flow Event
San Jacinto River Study Area

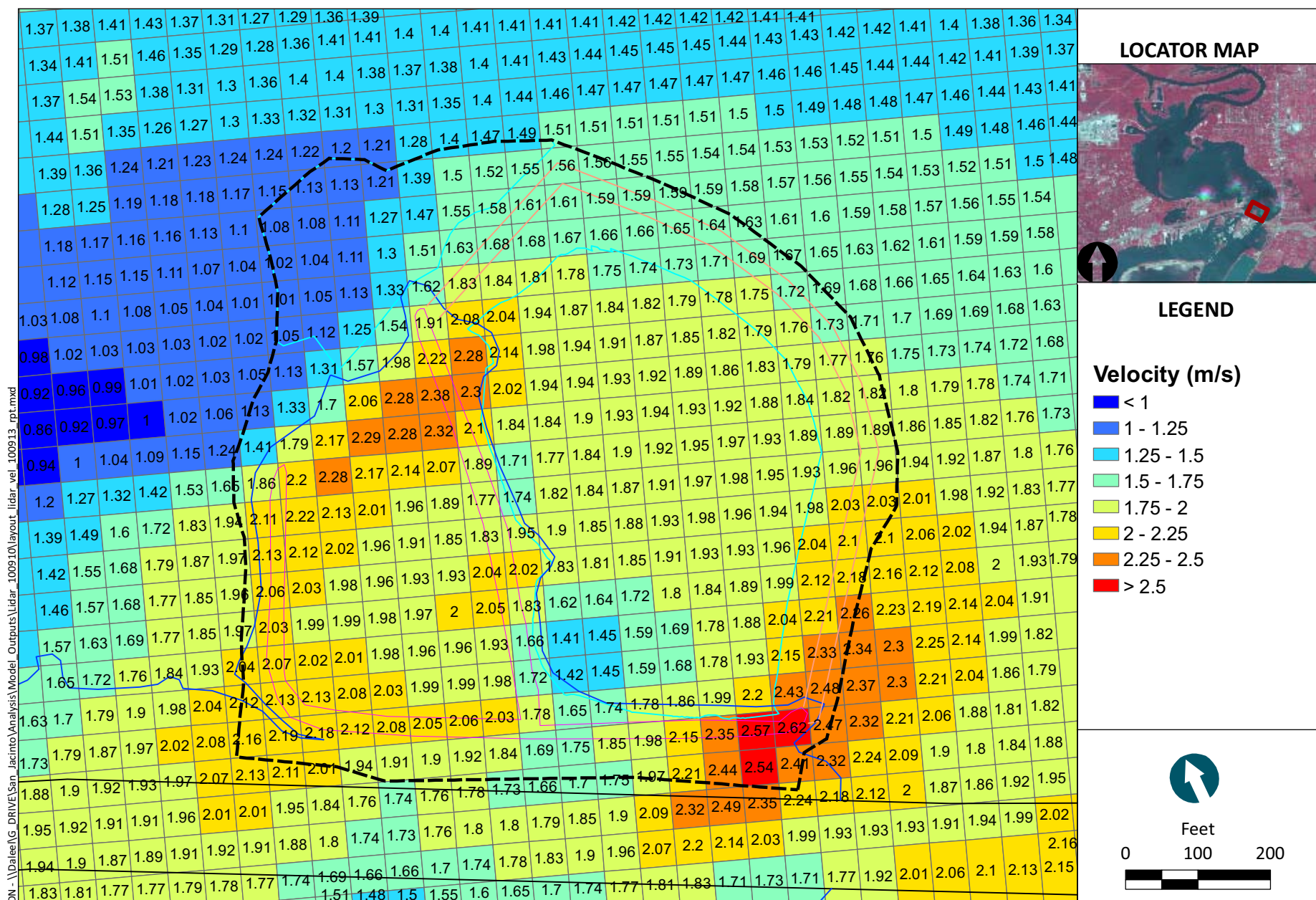
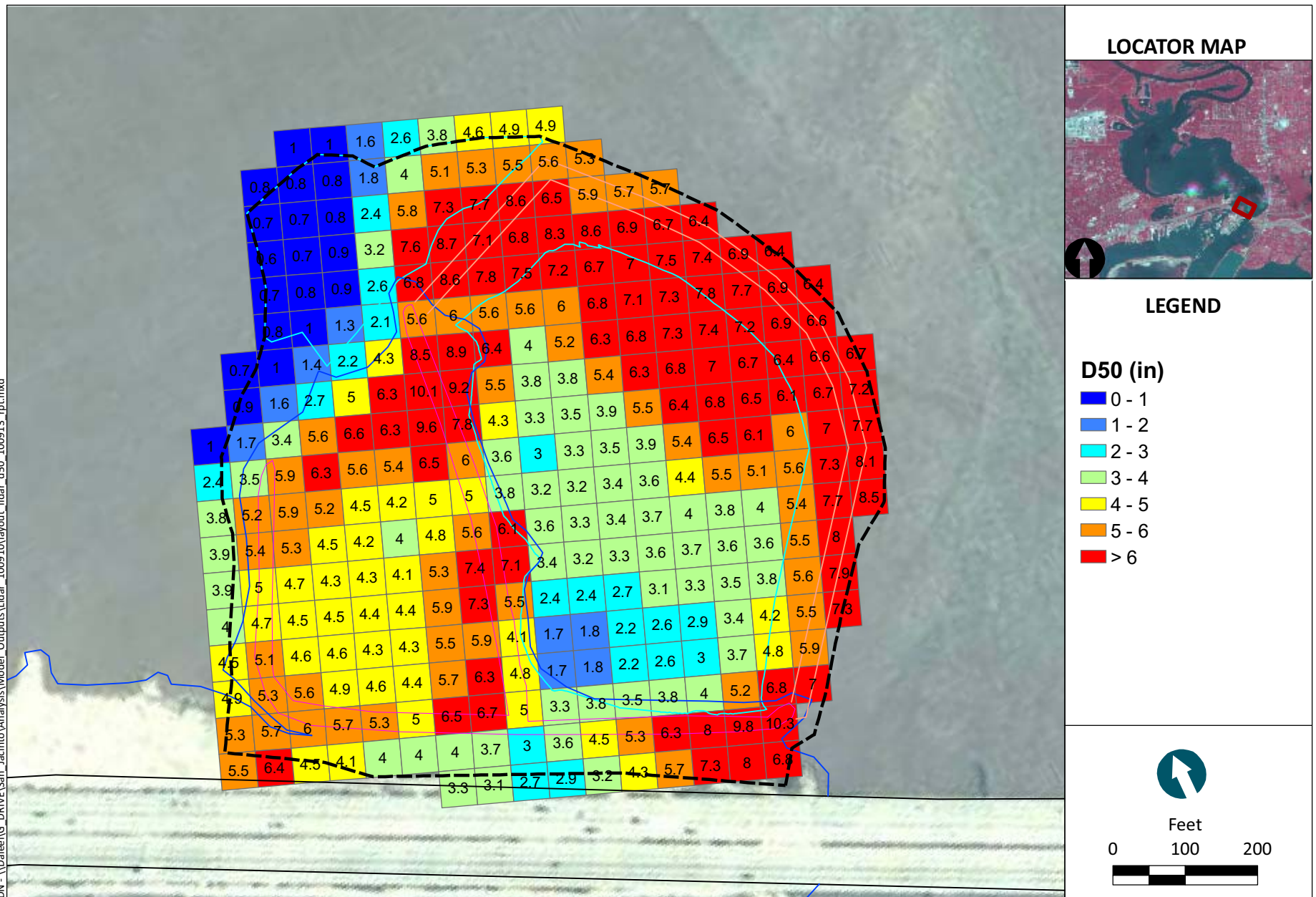


Figure 15
Spatial Distribution of Maximum Current Speeds During the 100-Year High-Flow Event
San Jacinto River Study Area

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APPENDIX H

GEOTECHNICAL ENGINEERING ANALYSES

TIME CRITICAL REMOVAL ACTION SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

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LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
GLE	general limit equilibrium
RAWP	Removal Action Work Plan
SJRWP	San Jacinto River Waste Pits Superfund Site (Site)
SPT	standard penetration test
TCRA	Time Critical Removal Action
VST	vane shear test

1 INTRODUCTION

This report summarizes geotechnical explorations, Site geotechnical conditions, and geotechnical engineering analyses performed in support of the design of the Time Critical Removal Action (TCRA) for the San Jacinto River Waste Pits (SJRWP) site (Site), located in Harris County, Texas. The following information is discussed:

- Subsurface conditions
- Bearing capacity of sediments
- Slope stability
- Filter design

1.1 Subsurface Conditions

Field explorations at the Site consist of 11 in-water borings. These borings were conducted using a barge mounted rotary drill rig. Samples were obtained by driving a split spoon sampler using the standard penetration test (SPT) or pushing a Shelby tube.

In addition to the explorations, the shear strength of surface sediments was measured using the Vane Shear Test (VST) at 18 locations. At each test location, the vane shear device was used to measure peak and residual undrained strength at 1-foot-, 2-foot-, and 3-foot-depth intervals below the mudline. Peak shear strengths in the upper one-foot-interval ranged from 38 to 440 psf for the 23 tests, with an average of 160 psf. The average undrained shear strengths of the two- and three-foot depth intervals were 240 and 320 psf, respectively.

Figure H-1 presents the locations of the borings and VST. Table H-1 summarizes the results of the VST.

The field explorations encountered a general soil sequence interpreted as shown in Figure H-2 and consisted of the following major soil units from the mudline downward:

Soft silt and clay. The upper sediment layer of each boring consisted of varying, stratified deposits of soft silt and clay, with occasional layers of sand. This layer varies in color from gray, to brown, to almost black and contains varying amounts of organic fibers, from trace to abundant. Large shells were found on the surface across most of the Site. This soft clay and

silt was observed up to an elevation of -26 feet NAVD88, and ranges in thickness from 13 to 22 feet.

Light gray sand. At most locations, underlying the soft silt and clay, was a layer of loose to medium dense, light gray sand. This sand layer is generally slightly silty, with fine- to medium-grained, sub-rounded particles. Occasionally, interbeds of gray clay were observed within this unit. The light gray sand unit ranges in thickness from 6 to 16 feet and was observed from elevations -12 to -34 feet NAVD88. Occasionally this layer was not observed in a boring when the soft clay transitioned directly to a thick layer of hard clay.

Beaumont clay. A hard, dry to damp, clay layer was observed from approximate elevations -24 to -65 feet NAVD88, and ranging in thickness from 27 to 41 feet. This material was light reddish-brown in color and graded to light-bluish-gray with depth. There was an occasional trace of sand and silt in the reddish-brown clay. Generally, the light bluish-gray clay graded to sandy clay to clayey sand with less plasticity with depth. In boring SJGB003, from elevation -65 to -107 feet NAVD88, the clay layer was observed considerably deeper than other borings and was observed alternating between dark and light gray and with a trace of wood fragments throughout.

Very dense sand. In borings SJGB002, SJGB003, SJGB005, SJGB007, and SJGB008, underneath the hard clay layer, a unit of medium to very dense, light gray, silty sand with pockets of clay was observed from elevations -56 to -130 feet NAVD88. This soil was found at the terminus of many of the 60-foot borings and was observed in the two 120-foot borings. In boring SJGB003, this unit was observed underlying the hard, dark gray clay with wood, existing as interbeds in the clay before gradually transitioning to a distinct layer and observed for a thickness of 9 feet until the extent of exploration was reached. In boring SJGB007, this unit was 39 feet-thick.

Lower hard clay. In boring SJGB007, a light bluish-gray layer of hard clay was observed underlying the lower layer of dense light gray sand. This lower layer of hard clay was observed from elevation -95 feet NAVD88 to the bottom of the exploration at -124 feet NAVD88 in SJGB007. An 11 foot-thick layer of this unit was observed in boring SJGB003 from -110 to -121 feet NAVD88. This material was very similar to the upper hard clay unit in terms of plasticity and grain size.

1.2 Geotechnical Engineering Evaluations

As described in the Removal Action Work Plan (RAWP), the project entails placement of granular cover to stabilize Site sediments. This section describes the geotechnical engineering design evaluations performed to support the design of the granular cover. The following evaluations were made:

- Bearing capacity of the near-surface sediments was evaluated to determine their factor of safety to support the load imposed by granular cover.
- Slope stability was evaluated to determine the factor of safety of the granular cover when placed on the relatively steep slopes present in a small area of the Site.
- Filter criteria were evaluated to determine whether sediments in the submerged northwestern area of the Site could support the granular cover without migration of *in situ* sediments into the granular cover interstices.

1.3 Bearing Capacity of Sediments

Bearing capacity for the proposed cap was evaluated using methods described in Appendix C of the ARCS Program “Guidance for *In situ* Subaqueous Capping of Contaminated Sediments” (Palermo et al. 1998). When cap material is placed on the surface of soft sediments, there is a potential for a bearing capacity failure directly through the *in situ* sediment. The initial cap lift thickness must be thin enough to prevent a bearing capacity failure resulting from the weight of the cap.

In typical foundation design problems, a factor of safety of 3.0 is used for calculations where there is potential for structural damage or impact to human safety. This is the suggested factor of safety presented in the ARCS guidance. However, the guidance does not distinguish between short-term and long-term bearing capacity considerations. Because of the transient nature of short term loading, lower factors of safety are often considered in geotechnical engineering design. Experience on other capping projects has shown that a factor of safety of 3.0 can be overly conservative when considering construction lift thickness. Because life, safety, and structural stability are not design considerations, and due to the short duration of construction, a factor of safety of 1.5 was considered appropriate for use in this analysis for evaluating the design cap lift thickness. Subaquatic cap placement has been successfully demonstrated at multiple Sites when designed using a bearing capacity factor of safety of 1.5.

This analysis evaluates the steady state, short-term stability of the cap and soft sediments during construction. Once the cap has been placed, consolidation of fine-grained *in situ* sediments will occur which will increase the shear strength of the sediment. Thus, the long-term stability of the cap against bearing capacity failure will be greater than the short-term stability.

The *in situ* sediments must have sufficient internal strength to prevent local shear failure. To evaluate this condition, the ultimate bearing capacity was calculated with the Terzaghi equations for local failure (Palermo, et al. 1998) using undrained shear strengths measured by *in situ* VST.

$$q_{ult} = \left(\frac{2}{3}\right) s_u * N_c \quad \text{(Equation H-1)}$$

Where:

q_{ult} = ultimate bearing capacity of sediment (psf)

s_u = undrained shear strength of in situ sediments from VST (psf)

N_c = Bearing capacity factor (dimensionless) = 5.14 for continuous strip footing (Terzaghi and Peck, 1967)

This equation applies to a cap placed on the surface of an entirely cohesive soil with an angle of internal friction, ϕ , equal to zero.

As previously discussed, during the May, 2010 field investigation, the undrained shear strength of the *in situ* sediments at the Site was measured at one-, two-, and three-foot depths using a field vane shear device. For determining the allowable thicknesses of the first lift of cap material, the 1-foot depth minimum value (38 psf) was used as a conservative first check:

$$q_{ult} = \left(\frac{2}{3}\right) 38 * 5.14 = 130 \text{ psf}$$

A factor of safety of 1.5 was used to compute the allowable bearing capacity:

$$q_{all} = \left(\frac{q_{ult}}{FOS} \right) \quad (\text{Equation H-2})$$

Where:

q_{all} = Allowable bearing capacity (psf)

FOS = Factor of Safety = 1.5

$$q_{all} = \left(\frac{130}{1.5} \right) = 87 \text{ psf}$$

The initial cap lift thickness that could be supported by the lowest strength *in situ* sediments without causing internal shear failure was calculated using the allowable bearing capacity and the following equation:

$$h = \left(\frac{q_{all}}{\gamma'} \right) \quad (\text{Equation H-3})$$

Where:

h = lift thickness

γ' = buoyant unit weight of cap material, if submerged (pcf)

$$\gamma' = \gamma - \gamma_w$$

γ = total unit weight of cap material (pcf)

γ_w = unit weight of water (62.4 pcf)

$$\gamma' = 135 \text{ pcf} - 62.4 \text{ pcf} = 72.6 \text{ pcf}$$

$$h = \frac{87 \text{ psf}}{72.6 \text{ pcf}} = 1.2 \text{ feet} \approx 14 \text{ inches}$$

The analysis above, which uses the minimum *in situ* shear strength measured in the field, indicates a cap lift thickness of 14 inches can be placed while maintaining an adequate factor of safety against bearing capacity failure during construction.

The maximum cap thickness is proposed to be 2 feet. Using the analysis methods described above, the factor of safety against bearing capacity failure was computed assuming that the undrained shear strength after consolidation would be similar to the average measured *in situ*

undrained shear strength at the 1-foot depth interval, or 160 psf. This analysis is intended to evaluate the long-term performance of the cap after construction has been completed. For a 2-foot thick cap, the factor of safety against bearing capacity failure is 3.8, which is adequate for support of the cap.

1.4 Slope Stability

To evaluate the stability of proposed caps on slopes, a specific area of interest was identified at the Site. A representative section was selected that included a steep slope area where a 12-inch thickness of Armor Cap Material A ($d_{50} = 3$ inches) coarse gravel material will be placed. Cross Section B is located at the northwest portion of the Site where the western cell transitions into the submerged northwest area (Figure H-1). Bathymetry indicates a relatively steep slope in this area of 2.25H:1V. Figure H-3 shows the interpreted Cross Section B-B that was used for slope stability analysis.

Slope stability was evaluated using Rocscience SLIDE 6.0 computer software for slope stability analysis. Soil profiles and properties are input in the model and then trial runs are conducted by the software to determine the critical slip surface – that is, the failure surface with the lowest factor of safety. The software uses limit equilibrium methods to calculate stresses (loads) and strength (resistance) for each slip surface evaluated.

General Limit Equilibrium (GLE) interslice force function methods were used for the analysis. Stability evaluations were conducted by inputting the geometry and stratigraphy of existing or proposed slopes and entering corresponding soil and water parameters (e.g. water elevations, soil strength model, soil density, cohesion, friction angle, etc.). The software processes this information to generate the factor of safety associated for the various failure surfaces evaluated.

In situ soil properties used for the slope stability evaluations were obtained from laboratory consolidated-undrained triaxial tests, physical property measurements, VST measurements, and correlations based on blow counts from samples collected during the field work described above. Additionally, physical properties of the proposed capping materials were estimated based on the nature of the proposed cap materials and estimated expected density. Table H-2 summarizes the input properties for the *in situ* and capping materials that were

used in the model. Both circular and non-circular surfaces were checked, and the software performed a search for the critical (i.e., lowest factor of safety) slip surface.

Table H-2
Soil Inputs for Slide 6.0 Slope Stability Analyses

Material	Saturated Unit Weight (pcf)	Undrained Conditions		Drained Conditions	
		Friction Angle (degrees)	Cohesion (psf)	Friction Angle (degrees)	Cohesion (psf)
Armor Cap Material A	135	34	0	33	0
Soft Silt and Clay	107	0	40 + 20/ft up to 120	15	100
Light gray sand	110	29	0	29	0
Beaumont clay	120	0	1000	17	50

Based on the results of the stability analysis, the section evaluated is expected to have a static short term factors of safety of 1.3 or better, and static long-term factors of safety of 1.5 or better, which meet the criteria acceptable by the USACE (2003). Results of the stability analysis are presented in Table H-3.

Table H-3
Results of Slope Stability Analysis

Conditions	Short Term		Long Term	
Failure surface	Non-circular	Circular	Non-circular	Circular
Soil Properties	Undrained	Undrained	Drained	Drained
Factor of Safety	1.42	1.43	2.05	2.09
USACE recommended FOS	1.3	1.3	1.5	1.5

Appropriate construction techniques should be used to limit the potential for slope instability during construction. This would involve the placement of materials in a “bottom up” fashion, whereby materials are first placed at the toe of a slope and construction proceeds towards the top of the slope. In this way, cap materials will be continually placed against a

firm toe support to minimize the potential for cap material to ravel downslope. Materials should also be placed in lifts of approximately 6 inches along the face and top of the slope. This allows the soft silt and clay layer time to consolidate and develop extra strength.

1.5 Geotechnical Filter Design

Based on conversations with contractors, construction in shallow water will require the use of land-based or marsh buggy equipment operating in contact with the ground. To facilitate access and operations, the contractors will place a geotextile on the surface of the sediment prior to placing the granular materials. In addition to providing separation and reinforcement to support construction activities, this geotextile will act as a filter layer to separate the relatively fine-grained sediment from the coarser grained granular materials that will be used to stabilize the Site.

In deeper water, placement of a geotextile will not be necessary to support construction because granular cover will be placed from the water side and construction equipment will not operate directly in contact with the ground (i.e. mudline) surface. Because of anticipated difficulties in placing a geotextile in deep water, the contractor will be provided a granular material specification that will act as a blended filter and armor layer for use in this area. This section describes the design of the gradation for the filter material and the required blending that will be necessary to combine the filter with the armor material for use in deeper water.

The area of interest for filter design is specifically the Northwestern Area, as described in the RAWP. Filter design criteria were evaluated to ensure that the blended armor/filter specification is sufficiently fine such that the *in situ* sediments do not migrate into the armor/filter material and sufficiently coarse so that the filter material is not washed out of the armor material.

Design methods described in Wright, et al. (2001) were used to select gradation of the filter material, and to develop the recommendations for blending the filter and armor material into a uniform single gradation for placement.

The following input assumptions were used in evaluating the filter gradation:

Depth averaged river velocity in Northwest Area: 1.2 to 1.5m/s (100-year storm)	
d ₈₅ of <i>in situ</i> sediments:	0.14 to 0.19 mm
Layer thickness for blended armor/filter	12 to 18 inches

The evaluation of filter gradation criteria entails computing an acceptable range of d₅₀ for the filter material (a function of the d₈₅ of *in situ* sediments) and determining the d₁₅ and d₁₀₀ of the filter material using nomograms provided by Wright et al. (2001) (a function of d₅₀ of the filter material). The d₈₅ of the filter material is also checked for compatibility with the *in situ* sediment grain size and the armor material grain size using nomograms that are based on river velocity and thickness of the blended armor/filter layer.

Based on this evaluation, the following gradation was developed for the filter material. This material will be blended with the armor rock as described below.

Table H-4
Filter Material Gradation Requirements

U.S. Standard Sieve Size	Percent Passing
3/8-inch	100%
U.S. No. 4	50 to 90%
U.S. No. 10	10 to 40%
U.S. No. 200	0 to 4%

As described in the hydrodynamic analysis (Appendix G), the Northwest Area will require an armor size with d₅₀ equal to 3 inches.

Also described in the work by Wright, et al. (2001) is the recommended blending of the filter material with armor material. Based on this work, a blend of 20 percent filter material to 80 percent armor material (by weight) will be used for the Cap Material A described in the specifications and presented on the construction drawings.

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TABLES

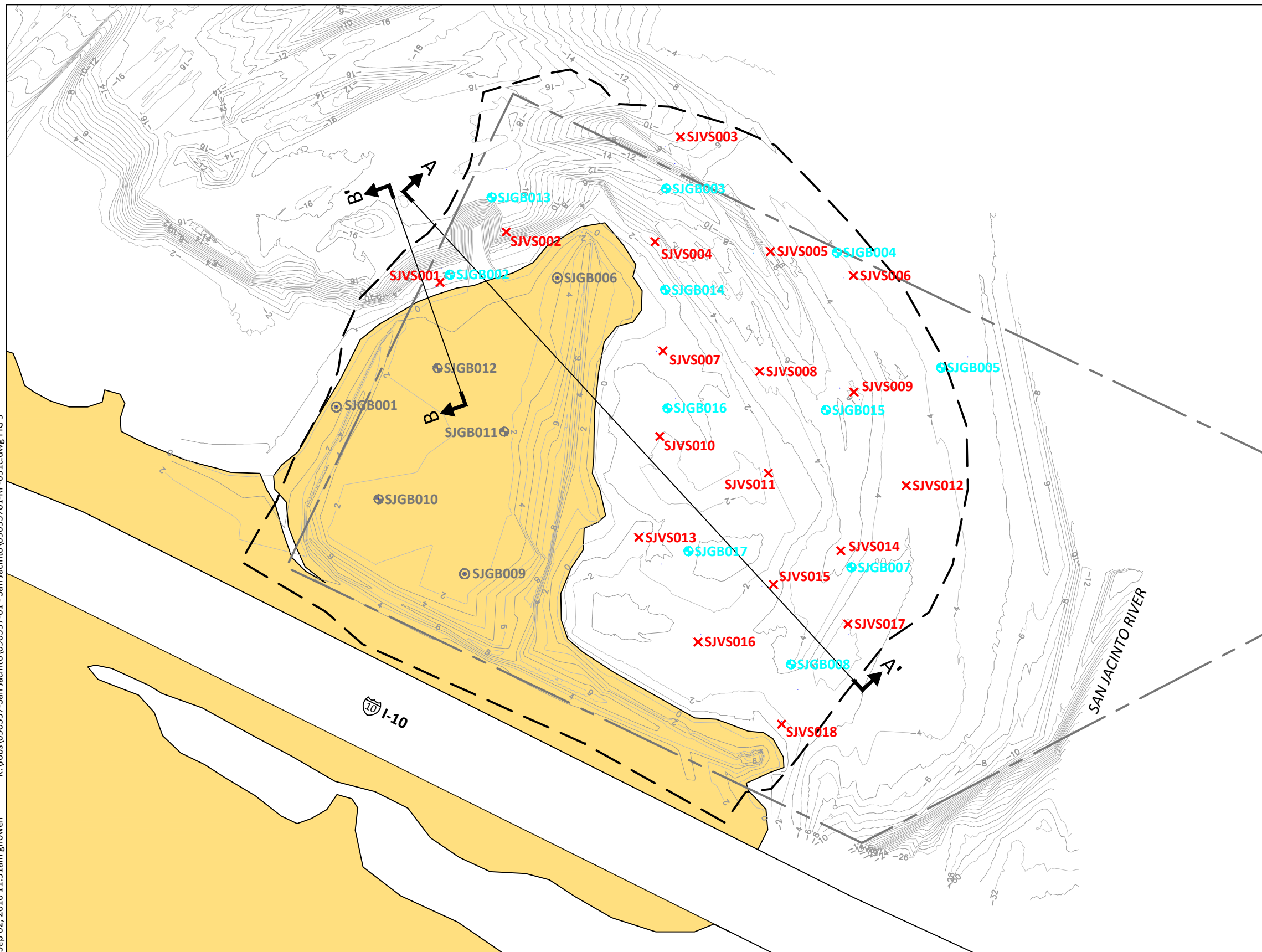
Table H-1
Vane Shear Test Results

Test Location ID	Sample ID	Water Depth (feet)	Depth below mudline (feet)	Undrained Shear Strength (s_u) (without rod friction correction)	
		(feet)	(feet)	Peak	Remolded
				(lbs/ft ²)	(lbs/ft ²)
SJVS005	SJVS005-GR1	13	1	132	104
			2	321	113
			2.5	331	113
SJVS017	SJVS017-GR1	3.7	1	444	76
			1.9	869	227
			3	831	180
SJVS018	SJVS018-GR1	3.5	1	189	151
			2	737	94
			3	548	94
SJVS016	SJVS016-GR1	4.6	1	38	19
			2	38	38
			1	66	8
			2	44	13
			3	66	18
SJVS015	SJVS015-GR1	4.4	1	170	123
			2	123	85
			3	208	76
			1	73	73
SJVS011	SJVS011-GR1	4.2	1	331	151
			2	350	132
			3	378	161
SJVS012	SJVS012-GR1	4.7	1	217	76
			2	189	113
			3	293	113
			3	397	--
			0.7	73	--
SJVS010	SJVS010-GR1	2.7	1	67	16
			2	73	--
			1	85	85
			2	170	66
			3	198	94
SJVS013	SJVS013-GR1	1.4	1	302	66
			2	180	180
			3	350	123

Test Location ID	Sample ID	Water Depth (feet)	Depth below mudline (feet)	Undrained Shear Strength (s_u) (without rod friction correction)	
		(feet)		Peak (lbs/ft ²)	Remolded (lbs/ft ²)
SJVS001	SJVS001-GR1	1.5	1	73	--
			1	66	47
			2	113	66
			3	132	47
SJVS002	SJVS002-GR1	13	1	76	113
			2	85	47
			3	85	94
SJVS003	SJVS003-GR1	6.6	1	331	66
			2	170	94
			3	520	180
SJVS004	SJVS004-GR1	3.6	1	208	104
			2	302	94
			3	265	104
SJVS006	SJVS006-GR1	4.6	1	189	66
			2	217	113
			3	283	66
SJVS007	SJVS007-GR1	0.9	1	208	28
			2	151	47
			3	142	85
SJVS008	SJVS008-GR1	6.1	1	142	113
			2	198	76
			3	236	104
SJVS014	SJVS014-GR1	6.7	1	151	47
			2	331	170
			3	444	161
SJVS009	SJVS009-GR1	7.7	1	94	66
			2	217	132
			3	444	180

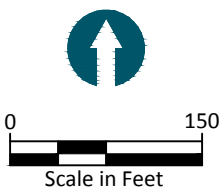
FIGURES

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LEGEND:

- SJGB001 Ⓞ Geotechnical Boring Sample Location (Proposed)
- SJGB016 Ⓞ Geotechnical and Chemistry Sample Location (Proposed)
- - - Approximate 1966 Alignment of Perimeter Berms (EPA)
- - - Property Line
- Approximate Limit of Vegetated Area (Shoreline)
- × SJVS009 Vane Shear Test Location (Actual)
- Ⓞ SJGB015 Geotechnical Boring Location (Actual)



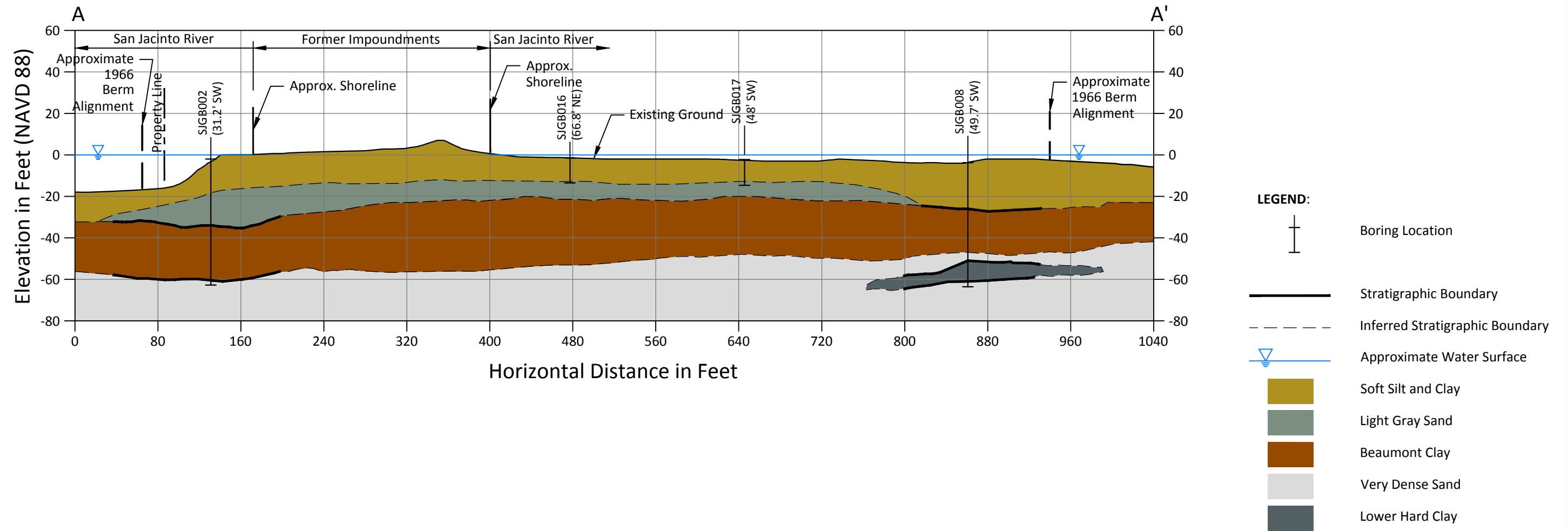
SOURCE: Drawing prepared from electronic file provided by US Army Corps of Engineers.
HORIZONTAL DATUM: Texas South Central NAD 83, US Survey Feet.
VERTICAL DATUM: NAVD 88.
NOTE: Proposed boring locations are depicted in gray scale.



Figure H-1
Geotechnical Boring and Vane Shear Test Locations
Appendix H - Geotechnical TCRA RAWP
San Jacinto River Waste Pits Superfund Site/MIMC and IPC

K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-051c.dwg FIG 6

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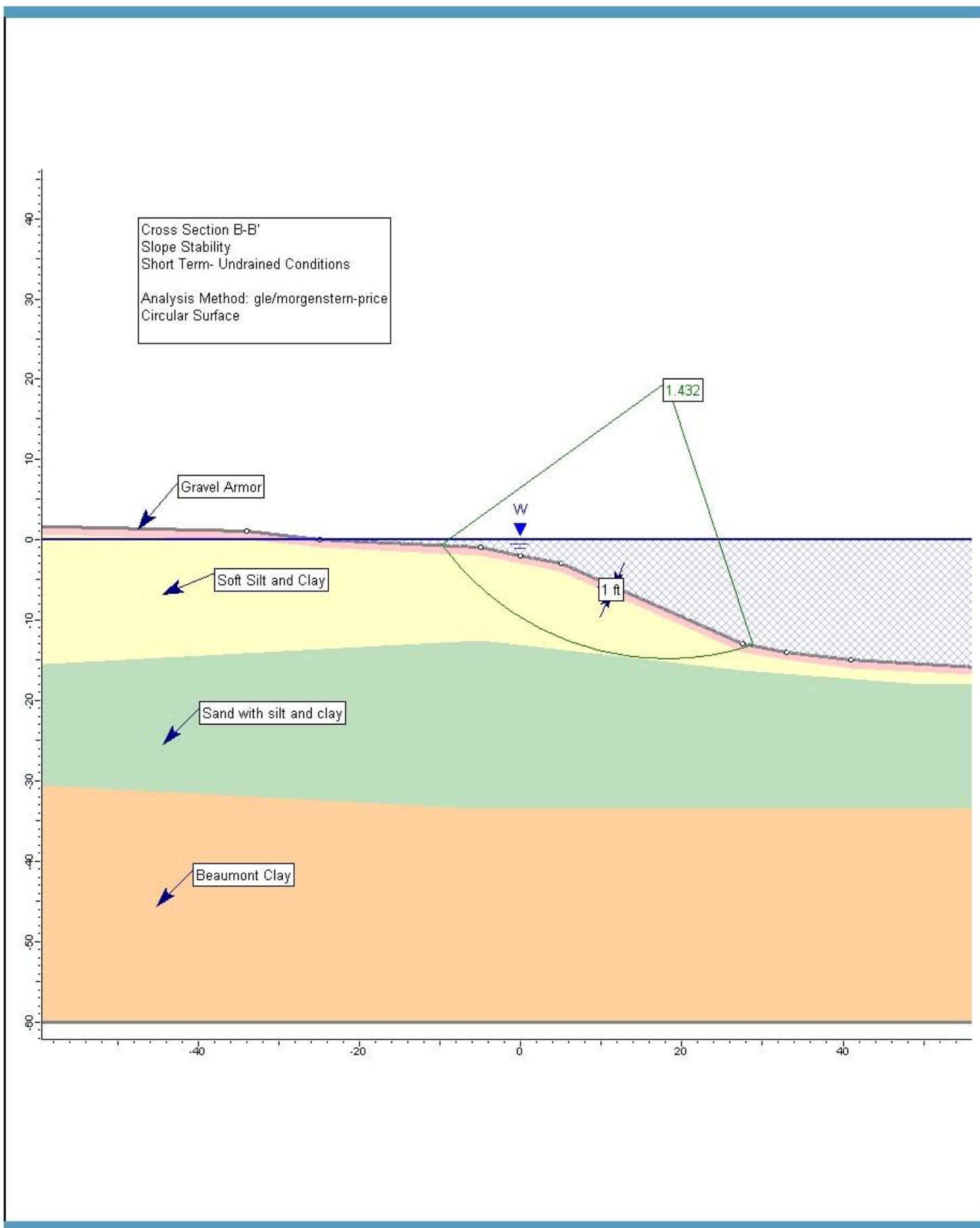


Figure H-3

Slope Stability – Cross Section B-B
 Appendix H – TCRA RAWP
 SJRWP Site /MIMC and IPC

APPENDIX I

BATHYMETRIC SURVEY AND ADCP DATA COLLECTION REPORT

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of:

McGinnes Industrial Maintenance Corporation

and

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September 2010

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1 INTRODUCTION

1.1 Brief Resume of Firm

The hydrographic and topographic surveys were performed by Hydrographic Consultants. Hydrographic Consultants, Ltd. (HCL) in February 2009 and June 2010. HCL specializes in meeting the challenges of maintaining up-to-date standards and equipment in this ever-changing environment, with the purpose of providing service and support to both the public and private sector in pursuit of their hydrographic survey needs in the marine environment.

2 EQUIPMENT UTILIZED

Topographic Equipment – set tide gauge from HGCSD 33:

- RTK – Trimble 5700/ Trimble 5800 with Trimmark III Radio
- RTK Software – Trimble Survey controller and Trimble Geomatics Office

Hydrographic Equipment:

- Echo sounder – Odom CV100 using a 4 degree 200 KHz transducer
- Positioning – Trimble DMS 232 using U.S. Coast Guard Navigation Beacon Corrections (DGPS – sub meter accuracy)
- Survey Software – Hypack operating on laptop with helmsman monitor
- Survey Vessel – HCL used the survey vessel “Surveyza” which is a 19 foot Carolina skiff with less than 1 foot draft. This type of vessel can operate in shallow waters which was necessary to cover the area required for this survey.
- Tide – HCL used 2 Onset gauges that use water pressure to monitor water elevation.

3 METHODS

Project Manager, Mr. Robert A. Roman, P.E. is an American Congress Survey & Mapping Certified Inshore Hydrographer. All bathymetric surveys and data processing were under his direct supervision. He supervised the ADCP deployment and data extraction for the Anchor QEA, LLC team.

1. Tide Gauge(s)

-
- RTK technology was employed to check and set vertical control for monitoring the water elevation. Due to the extent of the project and the water constriction at the I-10 overpass, HCL proposed to monitor water elevations at 2 locations, upstream and downstream of I-10. The gauge deployed was dependent upon the area HCL was surveying on any particular day.
 - All vertical control was set from HGCSD 33 and checked to other HGCDS monuments in the area. If any discrepancies were found, HCL notified Anchor QEA immediately before continuing with work.
 - Tide gauges are electronic and measure water elevations based upon monitoring water pressure and barometric pressure (necessary to cancel out atmospheric effects on water pressure). Gauges monitored water elevation on 30 second intervals during the course of the survey.

2. Hydrographic Survey

- The hydrographic survey was performed using survey procedures, data collection equipment, methods and densities and equipment calibration for this work followed the criteria for Navigation and Dredging Support Surveys for soft bottom materials as given in the U.S. Army Corps of Engineers Hydrographic Survey Manual EM 1110-2-1003, dated January 2, 2002. HCL regularly performs hydrographic surveys to these standards and is thoroughly familiar with the USACE document and the accuracy requirements.
- As noted in Section 5.1.1 – the proposed grid was developed based upon both HCL’s knowledge of the area and the requirements for preparing an accurate 3-D model.
- Surveys were to DGPS (sub meter) horizontal accuracy and to a vertical accuracy consistent with the USACE requirement for dredging support surveys for soft bottom materials.
- Surveys were conducted using hypack software integrated with the echo sounder and DGPS positioning systems to continuously in real-time record both position and depth along the course of each transect.

HCL utilized a shallow draft Carolina Skiff with a center hull transducer. This allowed HCL to maximize the access in the areas of limited depth of water. Additionally, HCL included

extra time in the cost proposal to account for having to cover much of the area during periods of high tide.

4 SURVEY FEBRUARY 2009

4.1 Grid Survey Pattern Based on Knowledge of the Area

HCL reviewed the primary survey area boundary in conjunction with aerial data of the San Jacinto Waste Pit Site and NOAA chart 11329 and concluded that a grid layout is not the optimal layout to economically model the area. Rather than survey a grid pattern, HCL proposed to survey a series of transects that best model:

- The San Jacinto River contour
- The terrain surrounding the waste pit Site, and
- Denote channel features surrounding or leading to the waste pit Site

GENERAL LAYOUT NOTE: HCL prepared the plan based on their knowledge of the area and as an efficient transect density to model the area for the RI/FS work plan. Anchor QEA added additional transects necessary to cover the area, HCL adjusted the proposal accordingly. The survey pattern for the area was laid out as such, with the area shown on Figure 8 being collected in the June 2010 effort as part of the TCRA activities:

4.1.1 Section I – South of I-10

The pattern for South of I-10 was a set of transects to map pattern of San Jacinto River as well as the area shown on NOTE A of Figure 1; this figure also displays the survey transects in red.

- Note A: A “Channel” is shown on the NOAA chart (dashed green area). HCL added transects to properly model this channel.

Also, HCL worked in this area before and much of the area noted as barge mooring area had barges and other vessels moored in that area. HCL worked around moored vessels, so the transect path deviated from the proposed path in areas where obstructions exist. Note that this area was not surveyed as part of the TCRA effort and is displayed to show continuity with the RI/FS Work Plan efforts.

4.1.2 *Section II – North of I-10*

The survey pattern displayed in Figure 2 consists of lines setup to best model the San Jacinto River Basin and general bathymetric contours shown on NOAA chart (Red Transects). Also, HCL defined what appeared to be a deeper area leading to the site (Blue Transects). Note Western most Blue transect, is Anchor QEA's Line #15.

The hatched portion of Figure 2 is the area immediately surrounding the waste pit area. The survey pattern for this area was not based on the NOAA charts, rather on the interpretation of aerial data. Section 5.1.3 details the work done in this area.

4.1.3 *Section III – Surrounding Area of Waste Pit Site*

Through a review of aerial data, HCL identified underwater bottom features visible at low tide. The hatched area in Figure 2 represents the surrounding area and waste pit site. Figure 3 shows an oblique view of the area where shallow water can be seen as well as cuts through the area. Also visible are remnants of land on the lower left near I-10.

Figures 2 and 4 show the I-10 North plan based on the NOAA contours, with Figure 4 showing an overlay on a low tide aerial photo. As Figures 3 and 4 shows, there are other features that needed to be defined to accurately model the area. A deep area that appears to connect with the “channel” leading into the back of the pit site is visible. Also visible are shallow bank areas surrounding the deep area. These areas in addition to the cut across the top of the area, peninsula and other features visible at low tide needed to be surveyed.

HCL denoted some of the additional bathymetry (blue lines) that were used to map features not visible on the NOAA chart, but visible in the aerial photos (most notably defining the shallow banks surrounding the deep water. However, other bathymetry was taken as needed in the field to document the existing bottom features as visible on the aerial data. Additionally, much of these features are shallow – so this area needed to be covered at high tide.

HCL allotted time in the cost proposal to pickup any features that were noticed in the field that were not adequately covered to model the area for development of the 3 foot X 3 foot grid or CAD contours.

4.2 Description of Interpolation Method to Generate 3-Foot Grid Data

4.2.1 3-D Modeling Method

To develop the 3 foot X 3 foot Grid a 3-D model from the survey was first developed. HCL utilized Trimble's Terramodel software for 3-D modeling. The key to any modeling is to;

- Collect data in such a manner that there is both sufficient density and data is collected at key contour changes and perpendicular to those contour changes. The survey pattern for the prepared by HCL in the designated area has been setup to provide sufficient data at key locations to economically model the area.
- Aid the modeling process by using break lines to link points of similar elevation and “steer” or direct the linking of data such that the model best reflects the actual conditions. Without break lines the closest points are linked and in most instances the computer software alone will not correctly model the area. (see example below)

Figure 5 shows a survey where the survey lines (magenta) were taken perpendicular to a contour (in this case a pipeline). Below the survey pattern in Figure 5 is Terramodel's 3-D model based on survey line data. In general the pipeline was discernable in the model.

Figure 6 shows a survey where the data was taken askew of the pipeline. This would be an example of the data not being perpendicular to a contour. The result was that the software created a 3-D model that was not representative of the area. Instead of 1 pipeline it appeared that multiple ridges exist.

This is an example of how the software alone could not generate the contours – the software linked the closest points, not the natural contour. Figure 7 on the following shows how the data processors used break lines to aid the modeling of the data even in situations where the data were not perfectly perpendicular to the contour.

By using break lines to aid in 3-D modeling, even in the worst circumstances (lines askew to the natural contour) a surface can be developed. In Figure 7, break lines were added to show how the data points should be linked. The result was a surface that, although not as perfect as that shown in Figure 5, provided a reasonable representation of the bottom.

The purpose of this example is to demonstrate that computer software alone does not inherently provide the best surface model of an area. As such, HCL 1) prepared a survey plan that provided the best starting point for a computer modeling of the area and 2) included in the budget data processor time to develop the model from the survey data acquired.

Once the base survey data were edited, it was color plotted and overlaid in such a manner that the data processor determined where break lines needed to be added. Additionally, as HCL prepared the survey layout with the assistance of the NOAA charts, HCL also used those charts with their contouring to assist in placing break lines.

The final stage was to review the 3-D model of the survey to ensure that the model properly reflected the bottom topography. Once the 3-D model was developed and accepted then the “Terramodel” software generated data on a 3 foot X 3 foot grid.

5 SURVEY JUNE 2010

5.1 Survey Pattern Based on Knowledge of the Area

HCL revised the layout per the information provided by Anchor denoting the areas of concern. Figure 8 below displays the revised layout.

5.2 ADCP Deployment

HCL deployed Anchor QEA’s SonTek Argonaut-SW ADCP at the location specified in the work plan. Figure 9 displays SonTek’s specifications sheet for the Argonaut-SW, and Figure 10 displays the gage deployment platform. HCL also retrieved, managed, and downloaded the ADCP data. These data collected were necessary for Anchor QEA’s draft hydrodynamic model simulations.

Data was collected for the 21 day period from June 16, 2010 to July 6, 2010, to calibrate the hydrodynamic model. A plot of the data and the ADCP deployment location are shown in Figures 10, 11, and 12 of Appendix G.

FIGURES

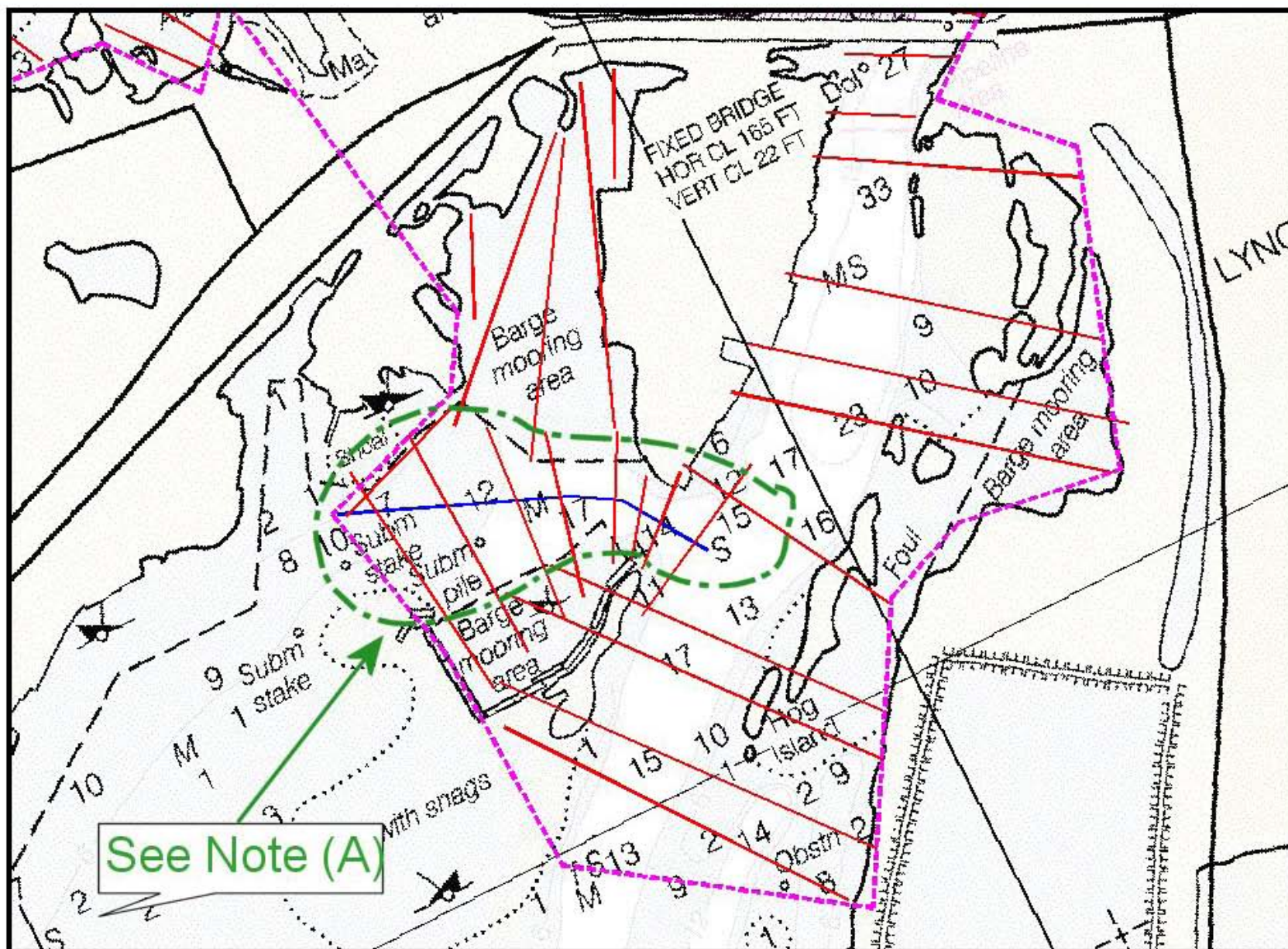


Figure 1

Survey Layout South of I-10
 Hydrographic Survey and ADCP Data Collection
 San Jacinto River Waste Pits Superfund Site

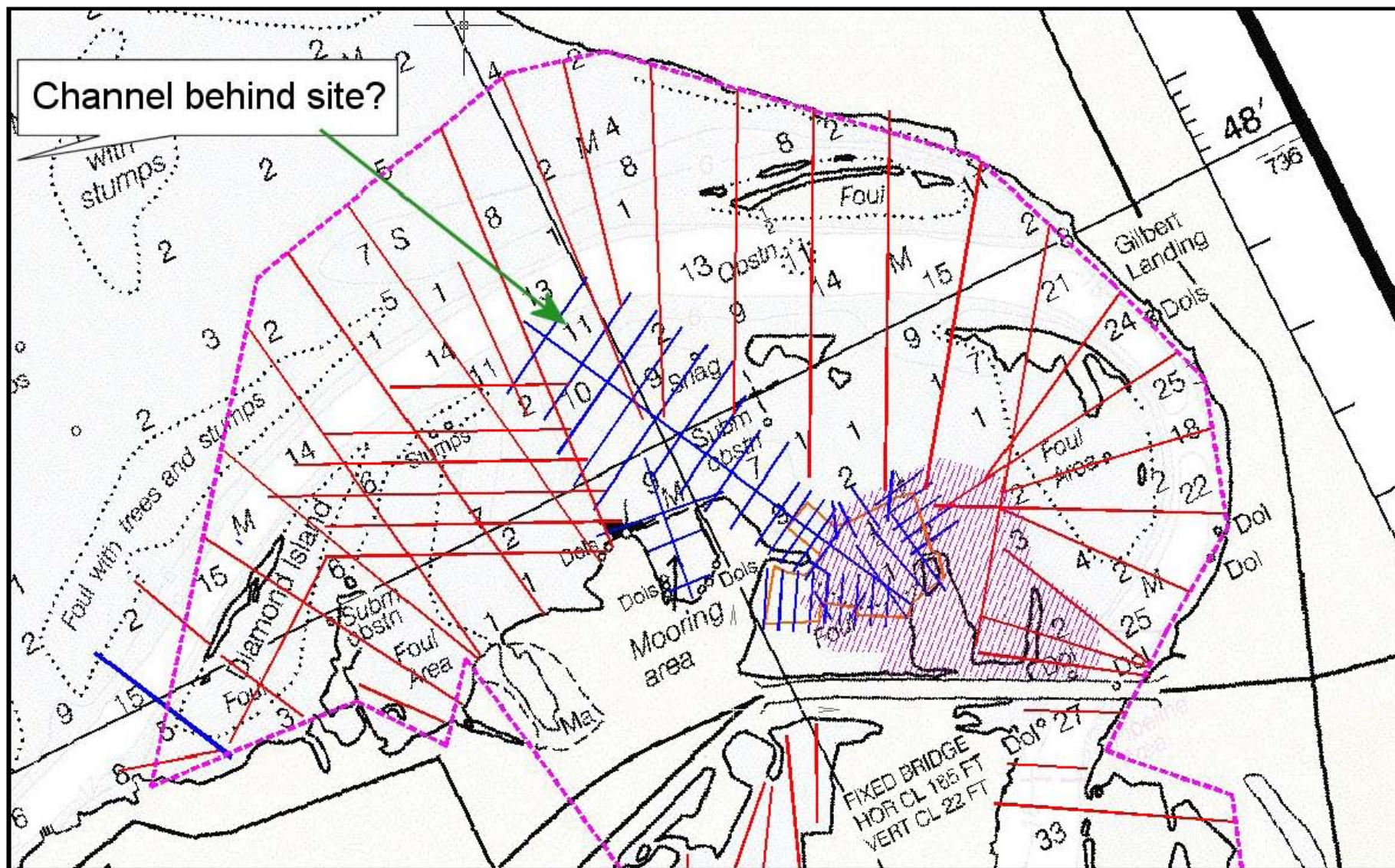


Figure 2

Survey Layout North of I-10
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

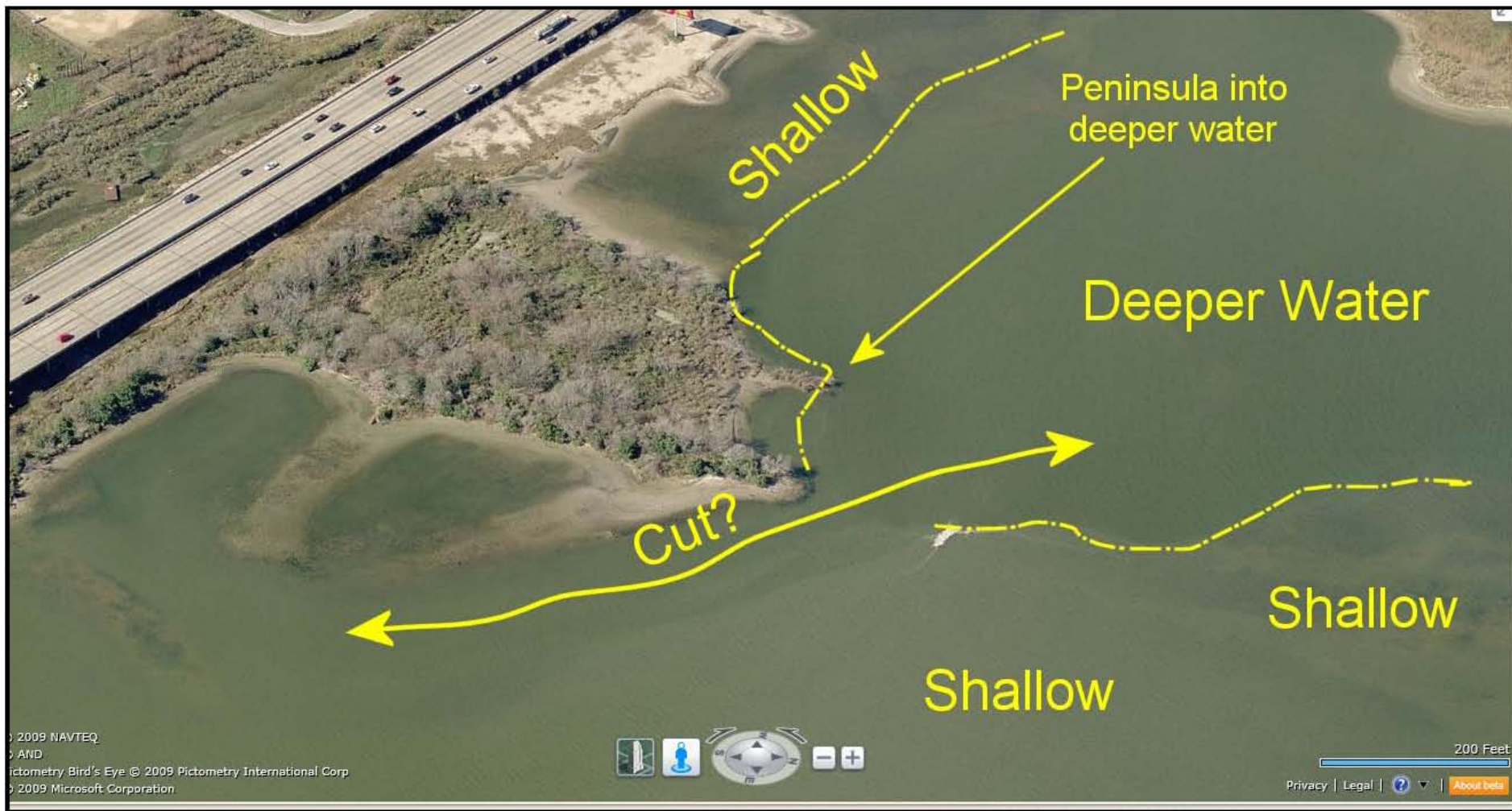


Figure 3

Oblique Photo of Waste Pit Site
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

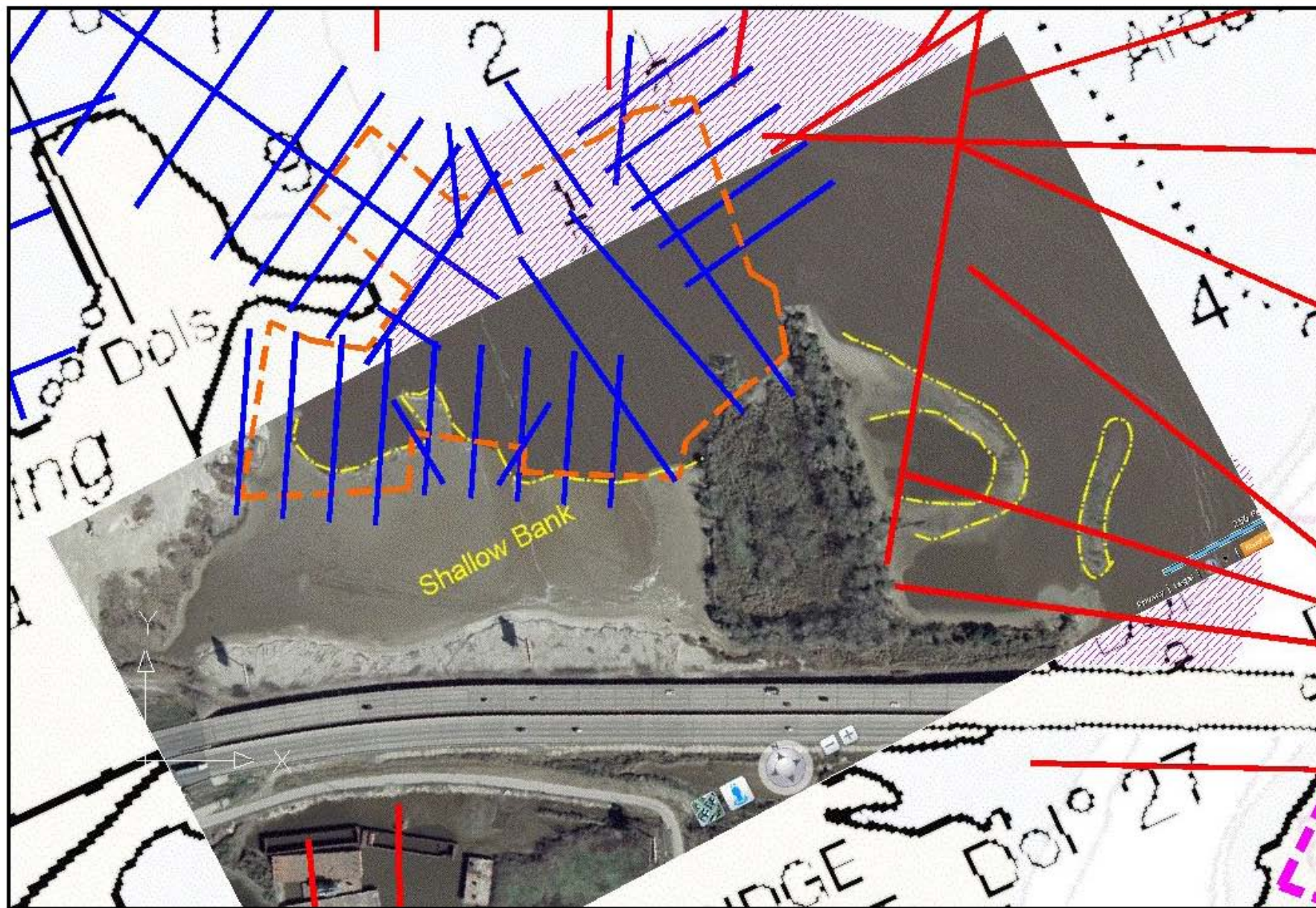


Figure 4

I-10 North Plan on Aerial Image of Waste Pit at Low Tide
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

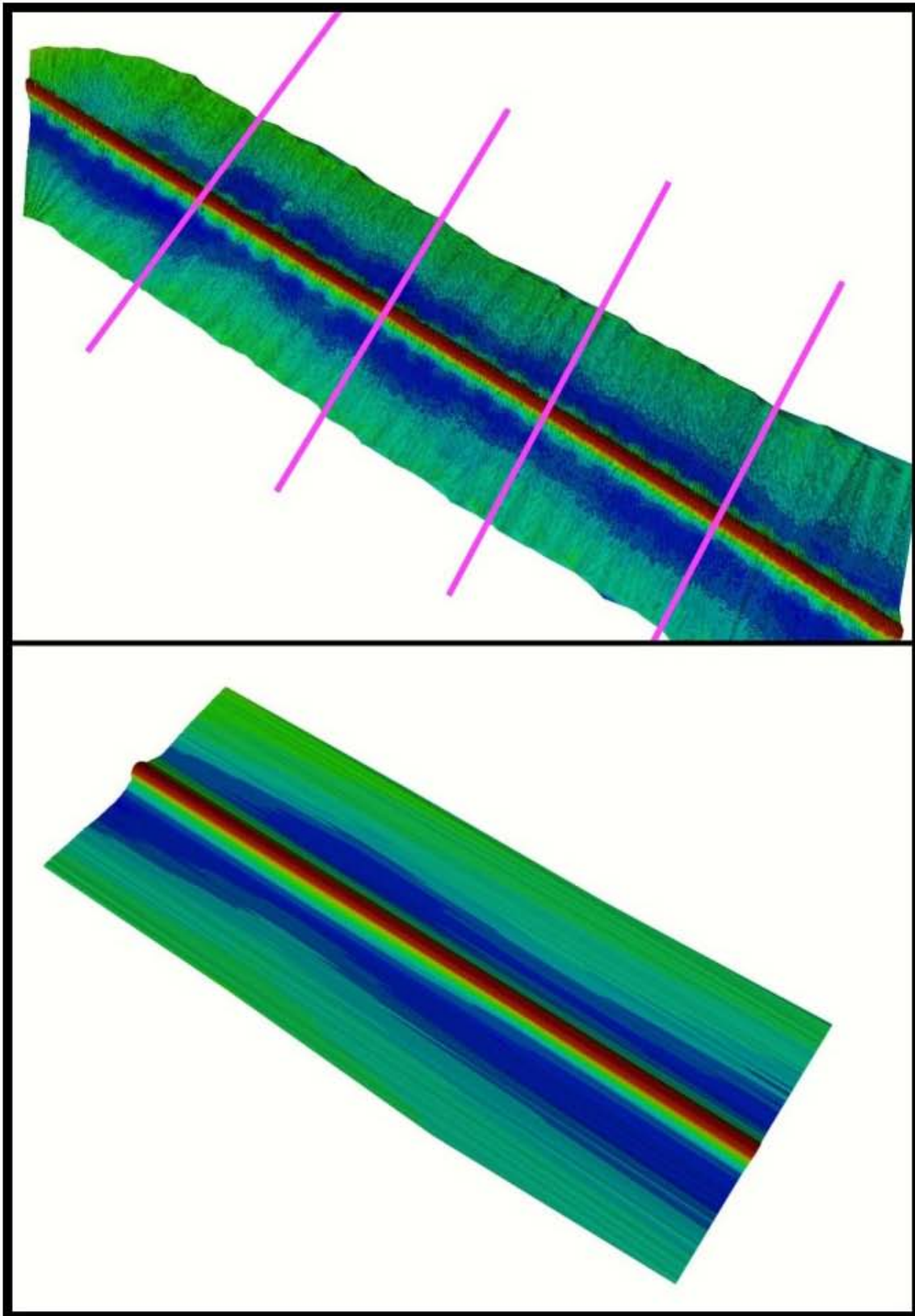


Figure 5
Survey Perpendicular to Contour
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

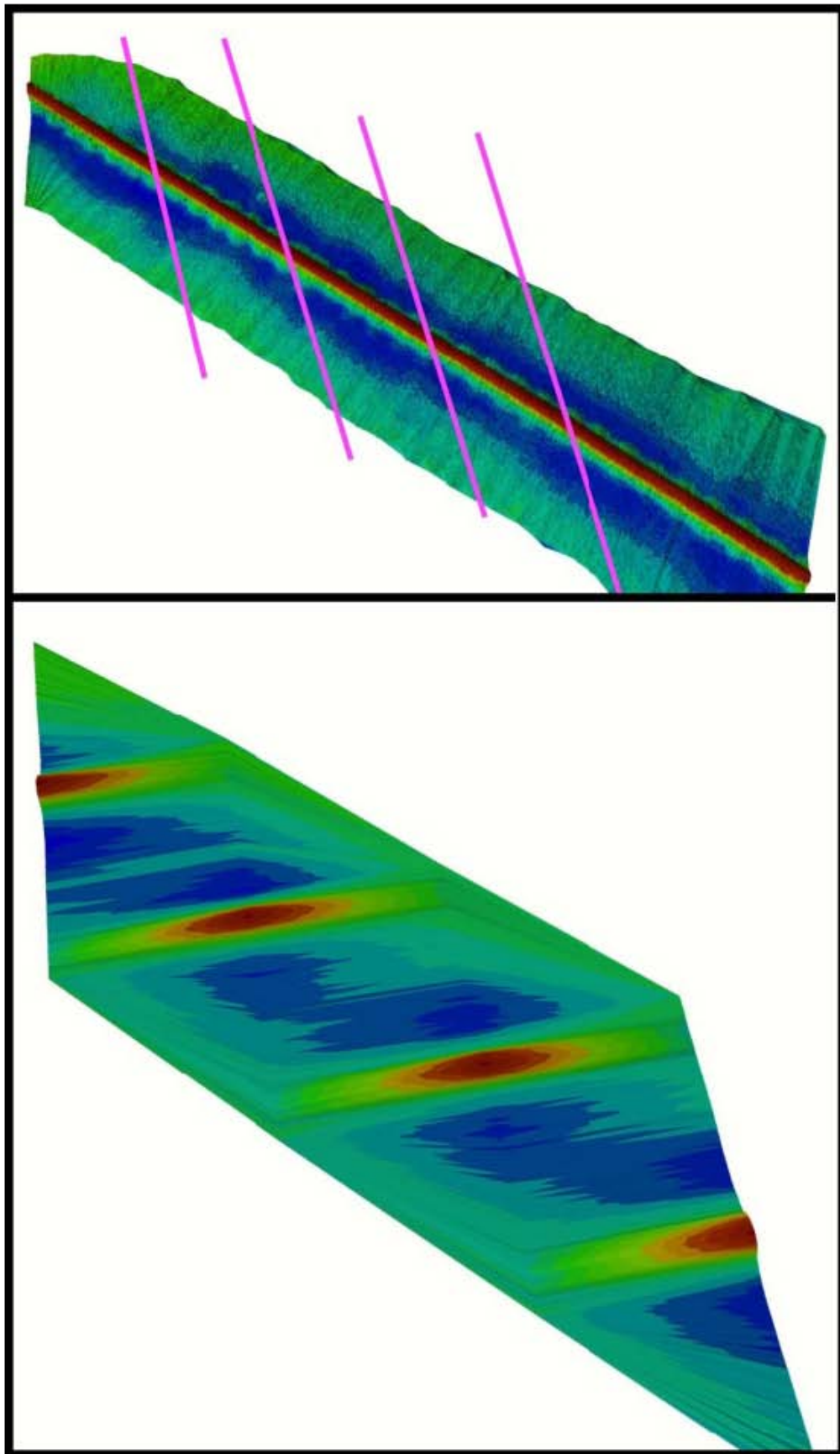


Figure 6
Survey Askew of Contour
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

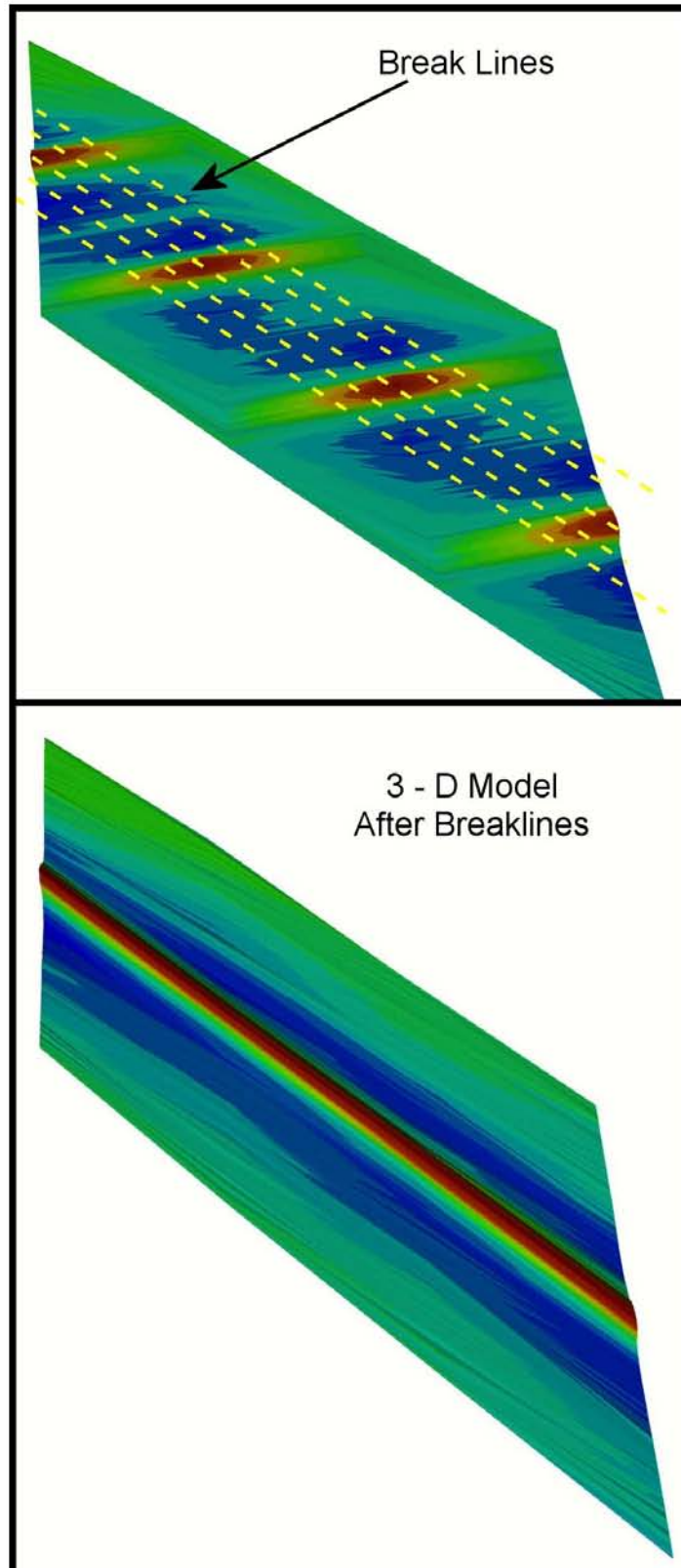


Figure 7

Break Line Aiding for 3-D Modeling
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

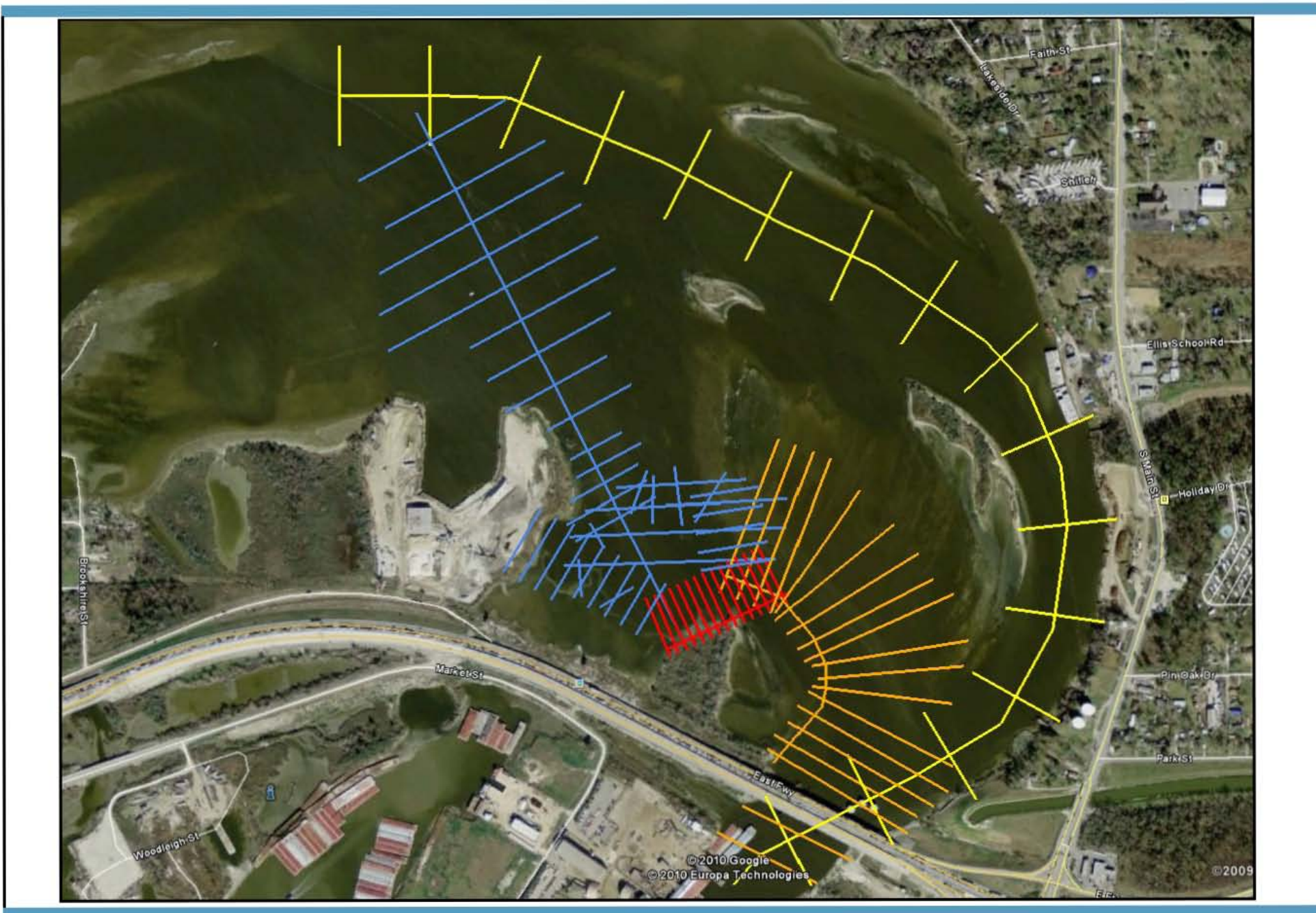


Figure 8

Revised Survey layout, June 2010
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

Argonaut-SW Specifications

Useful options and accessories make the Argonaut-SW a complete, turn-key solution!



Real-time Flow Display: Provides an easy-to-use interface for monitoring both output data and the system status.



SW Mounting Shoe: This streamlined, hard plastic casing helps deflect sediment in canals, channels and pipes. Also has slots for piping mounting.



Modbus Interface Module (MIM): Integrate into any Modbus-enabled system using Modbus RS-232 protocol. Acting as an RTU slave device, the MIM stores data in a series of registers so it can be reported to the master unit in real-time.



Sliding Mount: Rail system for easy instrument deployment and retrieval. A modular design allows for multiple length and depth configurations.

Standard Features

- 2-D velocity measurement (using 2 acoustic beams) along channel and vertical velocity components
- Water level measurement using vertical acoustic beam
- Automatically adjusts sampling volume location to measure the maximum possible portion of the water column
- RS-232/SD-12 communication protocol
- Real-time flow calculations using user-supplied channel geometry
- 4 MB recorder capacity (over 50,000 samples)
- Temperature sensor
 - Resolution: $\pm 0.01^\circ\text{C}$
 - Accuracy: $\pm 0.5^\circ\text{C}$
- ViewArgonaut Windows 2000/XP/Vista software for instrument setup, data collection, and post processing.
- PDA software (SonUtils and deployment module)
- Multi-cell current profiling
- Mounting plate

Velocity Profiling Range

- Maximum Depth: 5.0m (16ft)
- Minimum Depth: 0.3m (1ft)*

Water Level Measurement

- Minimum Depth:
 - Above transducer: 0.10m (0.3ft)
 - Total water depth: 0.20m (0.6ft)
- Maximum depth: 5.0m (16ft)
- Accuracy: $\pm 0.1\%$ of measured level, $\pm 0.3\text{cm}$ (0.01ft)

Water Velocity

- Range: $\pm 5\text{ m/s}$ (16 ft/s)
- Resolution: 0.1 cm/s (0.003 ft/s)
- Accuracy: $\pm 1\%$ of measured velocity $\pm 0.5\text{ cm/s}$ (0.015 ft/s)

Optional Features

- FlowPack velocity indexing software
- 4-20 mA and 0-5VDC output modules; possible variables are X velocity, Y velocity, velocity magnitude, temperature, SNR, stage, volume and flow.
- Custom mounting shoe (at left)
- Deployment sliding mount (at left)
- Flow Display (at left)
- Durable plastic shipping case
- RS-422 for cable runs longer than 100m



SonTek/YSI
3540 Summer Ridge Road
San Diego, CA 92121, USA
Tel: +1 (858) 546-8327
Fax: +1 (858) 546-8150
Email: inquiry@sontek.com

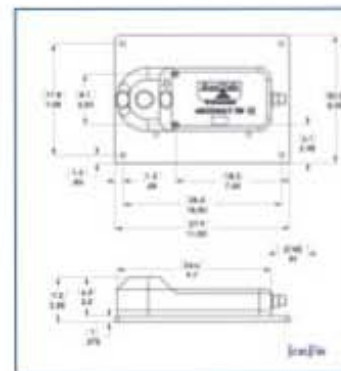
Physical Parameters

- Dimensions: 24.5cm (9.7 in) long by 10cm (4 in) wide by 6.3cm (2.5 in) high
- Weight:
 - In air: 1.2kg (2.6 lb)
 - In water: 0.15kg (0.3 lb)
- Pressure rating: 25m (80 ft)
- Operating temperature: -5°C to 60°C (23°F to 140°F)
- Storage temperature: 10°C to 70°C (14°F to 158°F)

Power Requirements

- Input power: 5-15 VDC
- Power consumption: 500 mW nominal

*Can operate in shallow depths down to 0.2m (0.7ft) with performance limitations. Contact SonTek for details.



SonTek/YSI, founded in 1992 and advancing environmental science in over 100 countries, manufactures affordable, reliable acoustic Doppler instruments for water velocity measurement in oceans, rivers, lakes, harbors, estuaries, and laboratories. SonTek/YSI is an employee-owned company.

SonTek and Argonaut are trademarks of YSI Inc., Yellow Springs, OH, USA. The Argonaut-SW is made in the USA. Lit. code 506-09-0509, June 2009. Specifications are subject to change without notice.

sontek.com

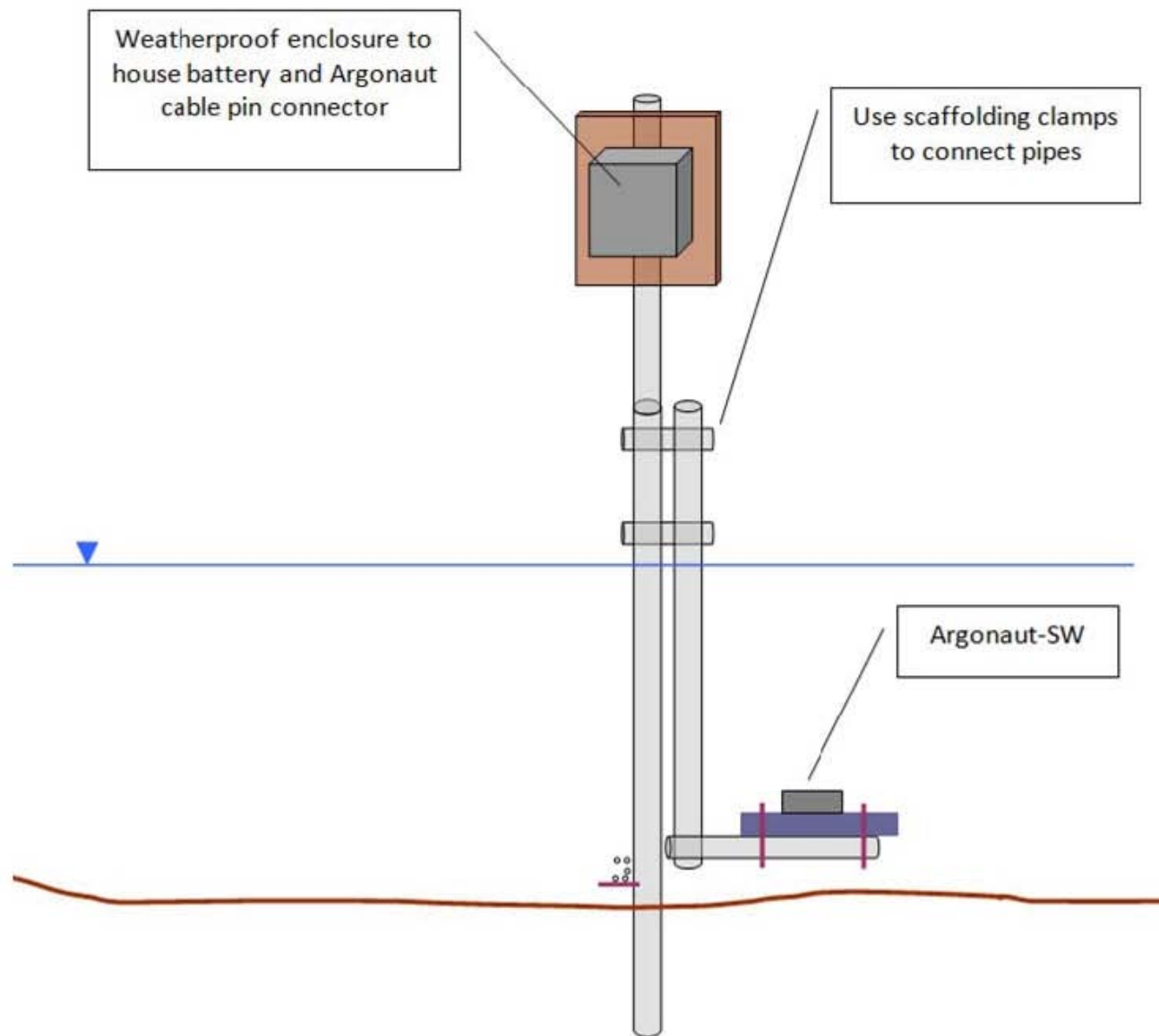


Figure 10

SonTek Argonaut-SW ADCP Deployment
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site